PMM

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

AUGUST
1956

devoted exclusively to:

DIE CASTINGS

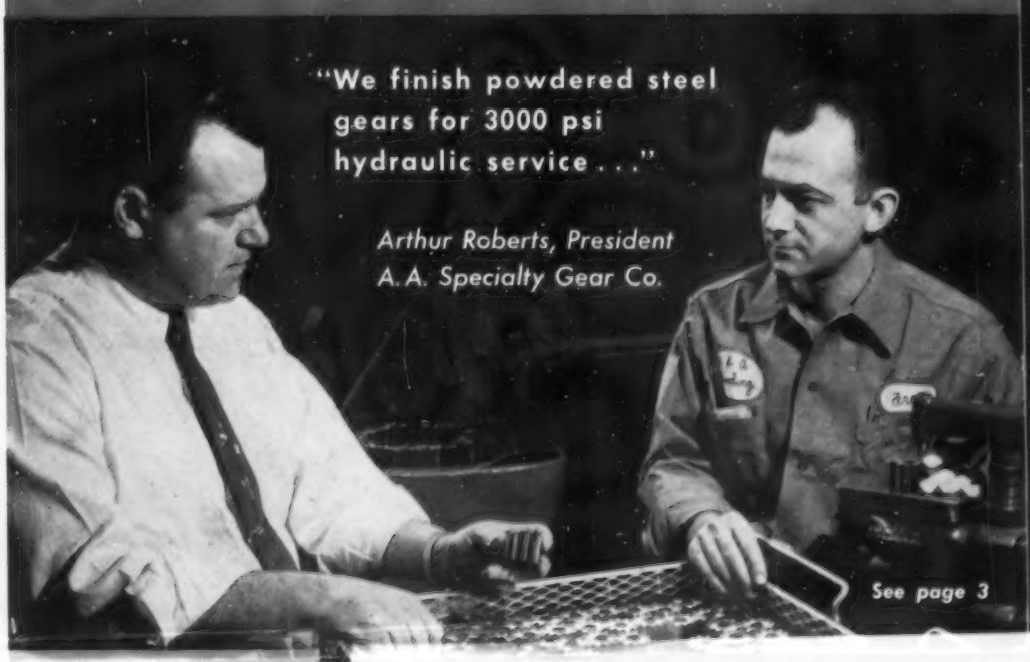
INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS



See page 3

UNIFORM HIGH-QUALITY

ALUMINUM

ALLOYS

...that always help you get better results

Aluminum alloys are produced under the most modern production methods to give you sounder, more uniform castings and trouble-free production.

- Standard and special alloys tailor-made to your specifications
- All alloys are production controlled to insure that every ingot is free from impurities and gas
- All shipments are palletized and shipped with a certificate of analysis

May we help you with your requirements, we welcome your inquiry.

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DIE SET-UP

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WITH

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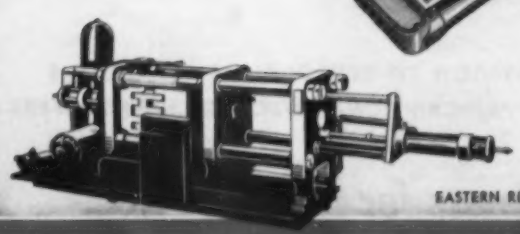
DIE-CASTING MACHINES

Built-in Rack and Pinion permits use of a ratchet wrench to quickly move the complete die-locking assembly in place to accommodate various sizes of dies.

Die-Lock Valve can be shut off and by-passed, with Inching Valve assuring added safety when setting up die. This permits instantaneous, micromatic control.



Faster set-up time is just one of the many "bonus" features which make Cast-Master today's outstanding choice in die-casting machines. To get the complete "bonus" story, send for the Cast-Master catalog, containing illustrations and specifications on eight new models.

SEND FOR CATALOG TODAY!

EASTERN REPRESENTATIVE: Milton Harmon, 18 Rock Road, Milford, Connecticut

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FOR RELIABLE, S-M-O-O-T-H PRODUCTION...

SWITCH TO DI-ALUBE

DIE-CASTING LUBRICANTS

DESIGNED *SPECIFICALLY* FOR THE INDUSTRY!

DI-ALUBE ASSURES:

MAXIMUM QUALITY!

- Eliminates gassification and porosity
- Finer finish, minimum stain and discoloration
- Minimum core drag
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- "Prescription — Perfect" uniformity assures non-varying performance

MAXIMUM PRODUCTION!

- Smooth, no-stick separation
- Unequalled metal flow and fill-out
- Minimum soldering
- Cleaner cavities, cores and pins
- Minimum scrap and down-time

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- Excellent film strength
- Non-injurious to die surfaces
- Heat-stable to 1000-plus degrees
- Cleaner dies — longer die life
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DI-ALUBE is unequalled in its field because — unlike "all purpose" lubricants — it is the "Prescription-Perfect" lubricant ***specifically designed*** to do one job and one job alone . . . that is to turn out the smoothest, cleanest die castings in the trade.

Developed and production-proved in one of America's largest industrial areas new DI-ALUBE is the preferred lubricant in the majority of mid-west die casting plants. A test run will prove its superiority in your operations.

DI-ALUBE does more than promise — it produces! Given a good die to work with DI-ALUBE will give you the smoothest, cleanest pull-away you've ever experienced, together with finer, stain-free castings.

•

SWITCH TO NEW DI-ALUBE — THERE'S A "PRESCRIPTION-PERFECT" GRADE FOR EVERY JOB!

• *Specialized Lubricants for Industry* •

MILWAUKEE METALUBE CORP.

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DIE-CASTING DI-ALUBE LUBRICANTS

For more information circle No. 45 on the Reader Service Card

COVER STORY

SINTERED steel oil pump gears can be precision ground to the dimensional and surface accuracy and requirements for high pressure service. For details see page 59.

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AUGUST, 1956 VOLUME 14 NUMBER 8

Precision Metal Molding

FEATURE ARTICLES

39 **HOW REPLACEMENT OF FLAME CUT** and welded pieces saved 50 percent.

40 **SLIP CASTING** of stainless steel powder — Part 1.

42 **THEY USE 70 CASTINGS** in 4 alloys in this modern duplicator.

46 **SHAPES UNLIMITED**

49 **ADCI STANDARDS** for aluminum base alloy die castings.

51 **SINTERED STEEL** for high shear strength service.

52 **WHEN YOU DESIGN** aluminum bronze permanent mold castings.

55 **NEW WAY TO CHECK** trace elements in zinc.

FINISHING SECTION

59 **HOW WE GRIND POWDERED STEEL GEARS** to 4 - 6 microinches.

65 **NEW METHOD OF IMPREGNATING.**

67 **DIES CAN BE MACHINED BY MOLECULAR EROSION.**

TECHNICAL REPORT

73 **HOW TO CONTROL TEMPERATURE** in die casting dies. Part 2, causes of thermal unbalance.

REGULAR DEPARTMENTS

6 Casting About
16 Data in Ads
21 Between the Lines
25 Letters to the Editor
28 People in the News
34 Recent Patents
69 Useful Literature
79 New Products
85 Industry News
89 Opportunities

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Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio

Madison-Kipp aluminum casting from an intricate die with coring on six sides.

DIE DESIGN MIRACLES

the Badge of Seasoned Skill

with **MADISON-KIPP** zinc and aluminum die castings

MACHINE DESIGN MARVELS are never a routine, casual experience. Some take a lifetime of effort. Some require long development after the invention. The only "short-cut" is not a short cut at all. It is vast, well grounded experience.

The die casting process has many inherent advantages over other processes. Full process utilization, however, provides the really important extras.

The seasoned and skilled mechanics at Madison-Kipp have been helpful to highly placed product engineers and designers for over a quarter of a century.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

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313 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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Photo by Hedrich-Blessing

Prompt delivery

of **DIE CASTING DIE STEELS** from warehouse stocks

...every piece ultrasonically inspected

Crucible warehouses from coast to coast stock over 460 sizes of CSM 2 and NU DIE V die casting die steels—1″ to 40″ wide—¾″ to 15″ thick! And they're all available for *prompt* delivery.

What's more Crucible warehouses are equipped to cut die steels to the size you want. The hacksaw pictured above in one of Crucible's warehouses, for example, is the largest made. It can accurately cut die blocks up to 40″ x 25″.

Huge stocks, plus versatile sawing and handling facilities, mean you get the steel you want *when you want it*. There's no need to wait for delivery from mill or forge shop when you can get *prompt* delivery from Crucible warehouse stock.

But there's more. Ultrasonic inspection of *every* piece of Crucible die casting die steel assures *sound die steel quality* every time. So next time you need die steels, look no further than your nearest Crucible warehouse. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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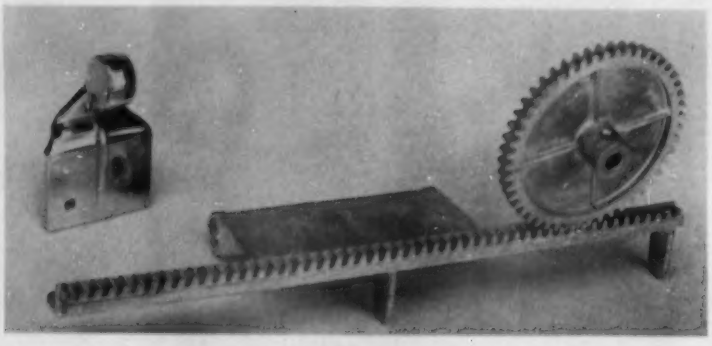
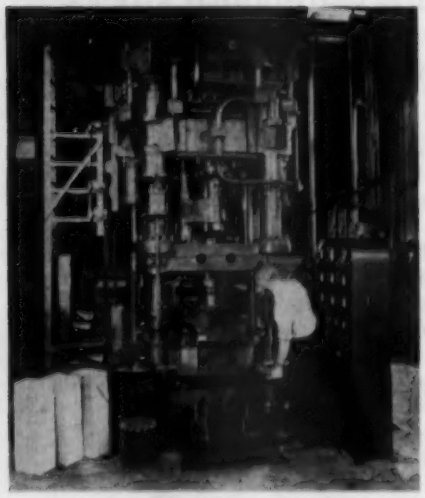
CASTING ABOUT

technical news of applications & processes involving precision metal moldings



THE BOOMING MARKET FOR AIR CONDITIONERS has led to the design of more and more complex units capable of many functions besides the original job of removing hot air. For instance, Amana has just introduced a new Year 'Round Air Conditioner that allows you to select six different combinations of cooling, heating, dehumidifying and ventilating by simply sliding one control lever back and forth. Key to the smooth, accurate and dependable operation is the sliding control mechanism, designed and built from certified zinc die castings. A die cast rack and spur gear assembly replaces the battery of control knobs and levers needed to perform these multiple operations on most air conditioners. The Amana sliding control mechanism uses a die cast spur gear which is attached to the shaft of a rotary electrical switch. The gear, in turn, is driven by a rack which is part of the die cast control carriage. As the carriage moves horizontally, it transfers the linear positioning motion into the desired damper door positions (through cable runs) and switch positions (through gear train). The control knob, providing finger tip control, is a chromium plated brass die casting attached with screws to the control carriage.

A NEW POWDER AND A BIGGER PRESS are two new developments in the field of powder metallurgy that may mean new uses for this process in tomorrow's products. Here are some details on these newly announced technical advances . . .



Largest hydraulically operated metal powder compacting press has been put into operation at The United States Graphite Company, Div. of The Wickes Corp. The 300-ton capacity press, built by Baldwin-Lima-Hamilton, has features which will permit the pressing of pieces having H-shaped cross sections such as double counterbores and double hubs. Among features of the press: double action top punch, floating die platen, shuttle-type feeder, independently floating core rod, and complete control of all motions.

Brass powder that produces stronger and harder pieces has come from a cooperative research project by metallurgists at New Jersey Zinc Company's Palmerton (Pa.) plant and the Armour Research Foundation of Illinois Institute of Technology. "Gains in strength and hardness bring brass powder metallurgy parts closely in line with properties of wrought metal parts," according to Robert Lubker, manager of ARF's metals research department.

Working under contract with New Jersey Zinc, Armour metallurgists tested about 100 combinations in their search for powder metal alloys with desirable age hardenability characteristics. Several alloys have been found, it is reported, that meet these goals that had been set for the program:

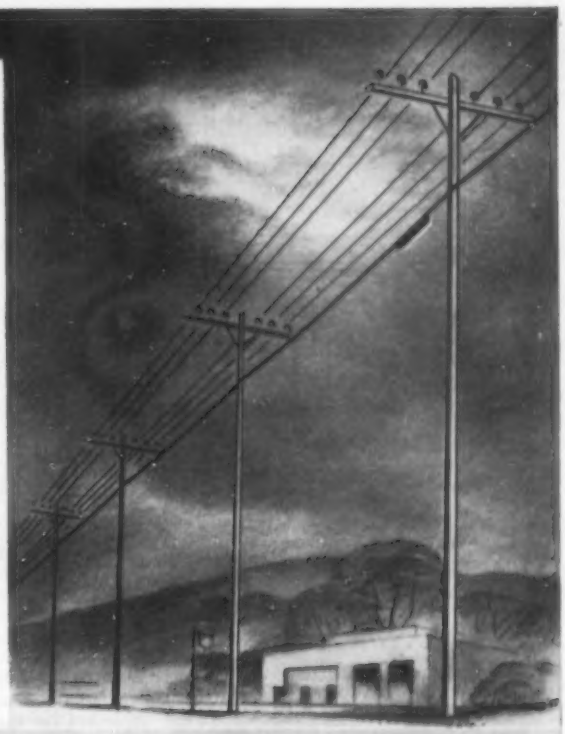
1. An alloy sufficiently hard for barrel finishing. (Many metals become dented when subjected to the barrel finishing process.)
2. An alloy that could compete in hardness and strength with wrought metal products.

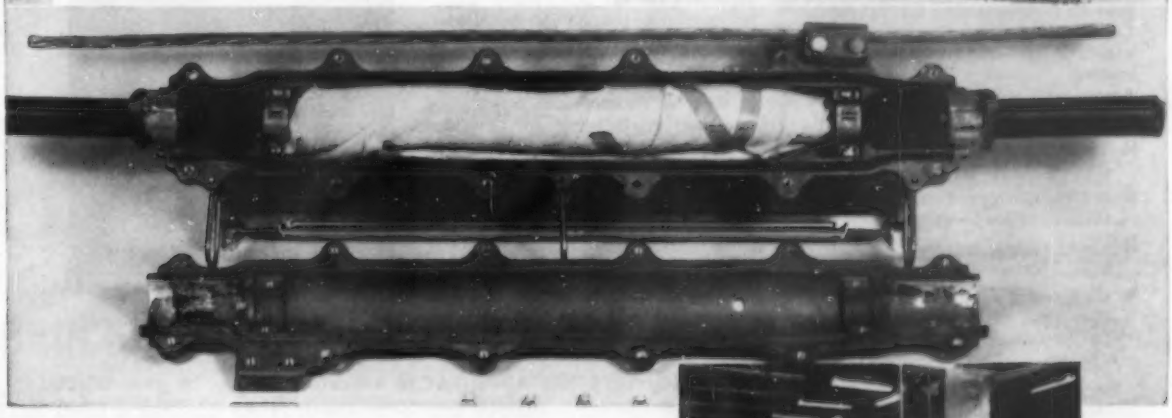
Continued on page 8

these die castings had to be

LEAK-PROOF

In critical communications work, after a splice has been made on a telephone aerial distribution cable, the splice must be protected against moisture. To accomplish this, Western Electric Company is producing a die cast aluminum splice case, basically cylindrical, the two halves of which are bolted together with suitable gasketing material. The housing thus forms a weather-tight seal capable of withstanding internal gas pressure of 10 P. S. I.





These parts are run at New England Die Casting Company. Many other parts, meeting the same exacting requirements of the most critical industrial applications, are run in the all-Lester-shop.

Mr. Charles W. Ohse, President of New England Die Casting, knows that he can offer his customers the best in die castings because he has the best in die casting machines—Lesters.

If you want additional information about Lester machines just drop us a line. And ask to receive the Lester-Phoenix house organ, "The Lester Press."

LESTER DIE CASTING MACHINES

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Dodge Custom-made
Special Alloy Steel Goosenecks
. . . for longer service life
. . . less maintenance

Here's the biggest news in die casting in years: a custom-made special alloy *steel* gooseneck that will outlast and outperform iron and alloy iron goosenecks currently available . . . and provide greater operational savings! Developed through years of experience and association with the die castings industry, Dodge Special Alloy *Steel* Goosenecks provide many advantages:

- Will outlast iron and alloy iron goosenecks by as much as 4-5 years.
- Maintenance problems are fewer because of long service life.
- Down time is reduced to a minimum because of long service life.
- Designed and made of special alloy *steel*, they prevent cracking . . . bottom breakout . . . spout erosion.

Each Dodge Special Alloy *Steel* Gooseneck is custom made to specifications by the Finished Products Division of Dodge Steel Company. Facilities are available for producing any size gooseneck for any die casting machine. Goosenecks are furnished either rough machined or machined with sleeves. Dodge provides a complete engineering service in the designing and production of steel goosenecks.

Your inquiries are solicited, without obligation, of course. Ask too, about pots and other die casting machine parts including nozzles, spouts, plungers, etc.

DODGE STEEL COMPANY
FINISHED PRODUCTS DIVISION
6501 Tacony Street
Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

Circle No. 28 on Reader Service Card

CASTING ABOUT

continued from page 6

CLEANING TRICK used in General Electric Company's Large Steam Turbine-Generator Department involves an unusual mixture of materials. They combine 10-15 percent of aluminum oxide with 85-90 percent of crushed peach or apricot seeds to clean rust and oxidized metal from steam turbine rotors, wheels and diaphragms. The aluminum oxide clings to the crushed seeds and acts as an abrasive, while the crushed seeds serve to keep the dust at a low level.

INCOME PROTECTION FOR ENGINEERS is a new feature announced by the American Society of Tool Engineers who have introduced a new type of group insurance plan for its members. Under its provisions, any member of ASTE up to age of 70 is eligible to participate in the plan which would pay up to $100 weekly for disabilities, plus accidental death payment.

3,000 POUND CLOSED-DIE FORGING produced at Aluminum Company of America's Cleveland plant is reported to be the world's largest. This tremendous forging, produced in a 50,000 ton press, measures 13 feet in length and forms the backbone of the fuselage and wing structure for the Navy's first multi-jet seaplane, the XP6M SeaMaster. Vital statistics: rough forged die blocks in armor-plate die steel weighed 75 tons; were whittled down to 60 tons by enormous duplicating machine; engineering and production time to make the dies totaled 1500 man hours; forging was made from a 4200 pound blank in Alcoa's alloy X7079.

The XP6M SeaMaster is a radically designed four-jet aircraft that is capable of 600 mph. It is a pioneer craft in the Navy's new mobile seaplane striking force.

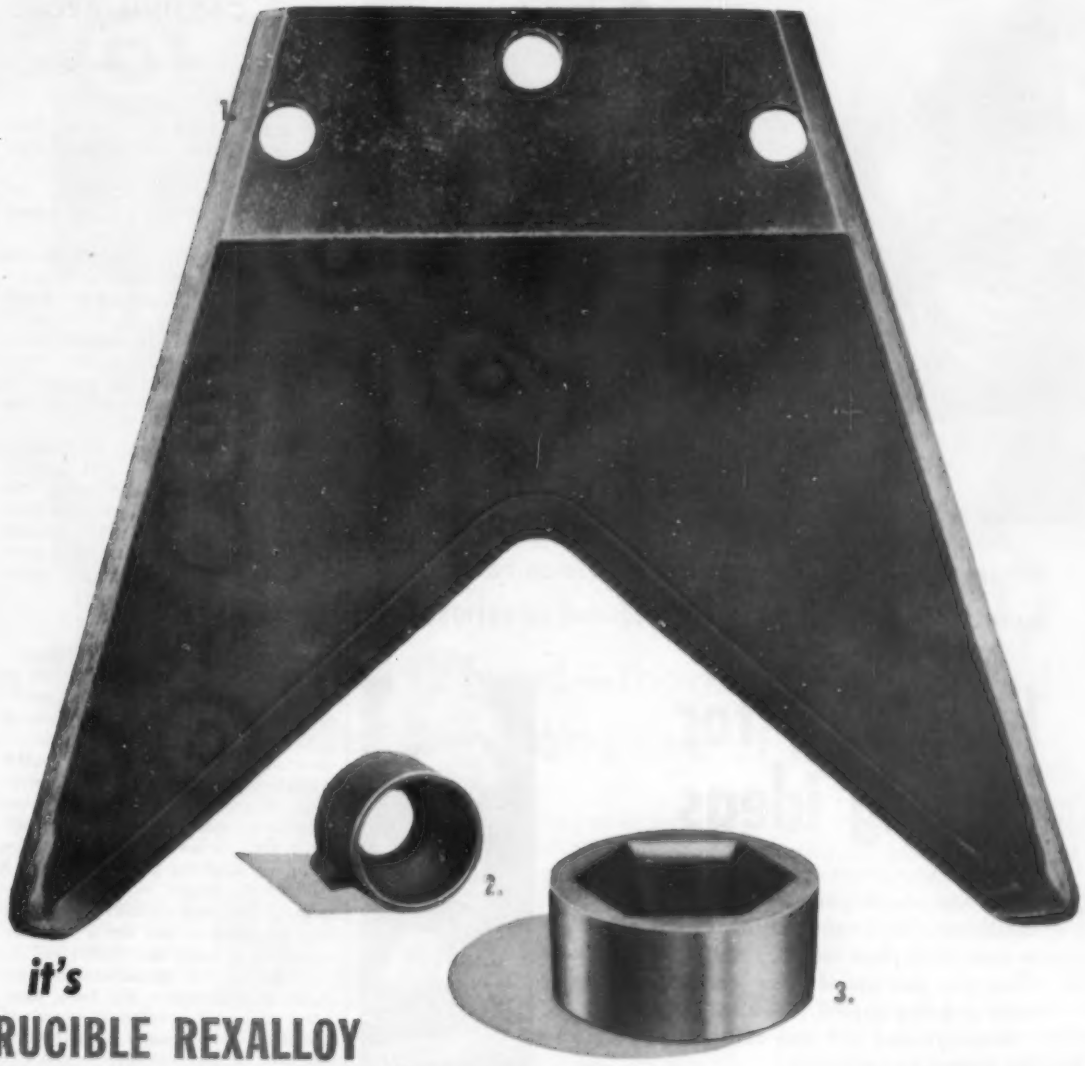
THE ENGINEERING APPROACH was summed up by two different speakers at Cleveland meetings of the American Society of Mechanical Engineers recently.

Commented Lad J. Bayer, chief industrial engineer for Warner & Swasey Co., "Design engineers are continually challenged either to maintain quality at lower cost or to improve quality at fixed cost. However, the engineer consistently finds himself handicapped through lack of cost information that would really guide his selection of quality levels within acceptable margins and at reasonable cost. All decisions are compromises based, at best, partly on available facts and partly on conditions such as personal conviction, faith and hunches and guesses. Facts are elusive things, consuming vast amounts of human energy, time and expense to seek out."

On industrial versus classroom engineering problems, Louis G. Gitzendanner, manager of mechanical systems engineering at G-E's General Engineering Labs, said, "In the typical academic problem, the method to be used is indicated by the subject matter currently being taught, and the assumptions, if any, are all stated, with the result that there is little opportunity for using imagination and ingenuity.

"On the other hand, the typical industrial problem is seldom clearly stated. Data available are usually incomplete or broadly stated. Extraneous and irrelevant data may be present. Assumptions are a matter of engineering judgment. The method of solution is a matter of choice and involves such factors as the degree of accuracy required, the time available, and the economics of the problem."

continued on page 10



it's

CRUCIBLE REXALLOY

for abrasion, corrosion and heat resistant parts...with better finish

1. One of a pair, this blade of REXALLOY A shears hot glass during manufacture of TV tubes. Liquid cooled between operations, it offers maximum resistance to wear, corrosion, and thermal shock. REXALLOY blades outperform previously used high speed steel shears by a wide margin.

2. Nozzle for jet type oil well rock bit cutter. Made of REXALLOY 51, it stands up exceedingly well under severe cold abrasive conditions encountered in drilling oil wells.

3. Extrusion die insert of REXALLOY 33. Inside contours are cast within a few thousandths of finished size. REXALLOY inserts produce as many as six to ten times as many pushes as conventional hot work tool steel extrusion dies.

Here's what Crucible REXALLOY means to you: Castings of high hardness, even at elevated temperatures . . . excellent resistance to both corrosion and abrasion . . . smooth, clean finish.

What's more, REXALLOY castings, when made by the shell-mold process, can be cast to any shape. Dimensions are held to closer tolerances than ever before . . . practically all machining and grinding operations are eliminated—especially important with hard super-alloys like REXALLOY.

So if your application calls for a part with one or more of these characteristics, REXALLOY shell-molded castings are the answer. They are moderate in price (less than investment castings), closer in dimensions and finish than conventional castings. Let your Crucible representative give you the complete story of what they can do for you. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information circle No. 22 on the Reader Service Card

Westinghouse pilot plant for precision castings speeds development, saves capital investment

Incubator for casting ideas

To help you prove your precision casting ideas and developments under production conditions, Westinghouse invites you to use its new pilot plant facilities at Blairsville, Pa. Thus you can speed your metals programs without heavy capital investment.

Westinghouse will also assist you in creating prototype quantities . . . or give you fast, dependable delivery on production quantities of precision investment castings (lost wax process), shell-mold castings and powder metal parts.

Consider molded metal parts for your product components requiring intricate shapes, close tolerances, difficult machining operations or component assemblies. Westinghouse has skilled metals engineers with broad experience to help show you the way to improved products, lower costs.

***Send today* for further details and a copy of DB 52-500. Also enclose a photo, drawing or sample of the part you want evaluated. No obligation. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.** J-05002

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING **TODAY!***

For more information circle No. 65 on the Reader Service Card

CASTING ABOUT

continued from page 8

12,000 SUPPLIERS in 44 states, District of Columbia and three foreign countries provide the materials, components and sub-assemblies for Chrysler Corporation's 42 manufacturing plants.

During 1955, according to Emlyn Lloyd, head of the company's purchasing activities, Chrysler employed the services of suppliers in 1,402 cities. Parts and assemblies purchased from these suppliers comprised approximately 60 percent of the total production cost of the corporation's cars.

Small businesses form the bulk of Chrysler's suppliers . . . 71 percent of them employ fewer than 100 persons and 18 percent employ from 100 to 500 persons. Only five percent employ between 500 and 1,000 persons and six percent employ more than 1,000 persons.

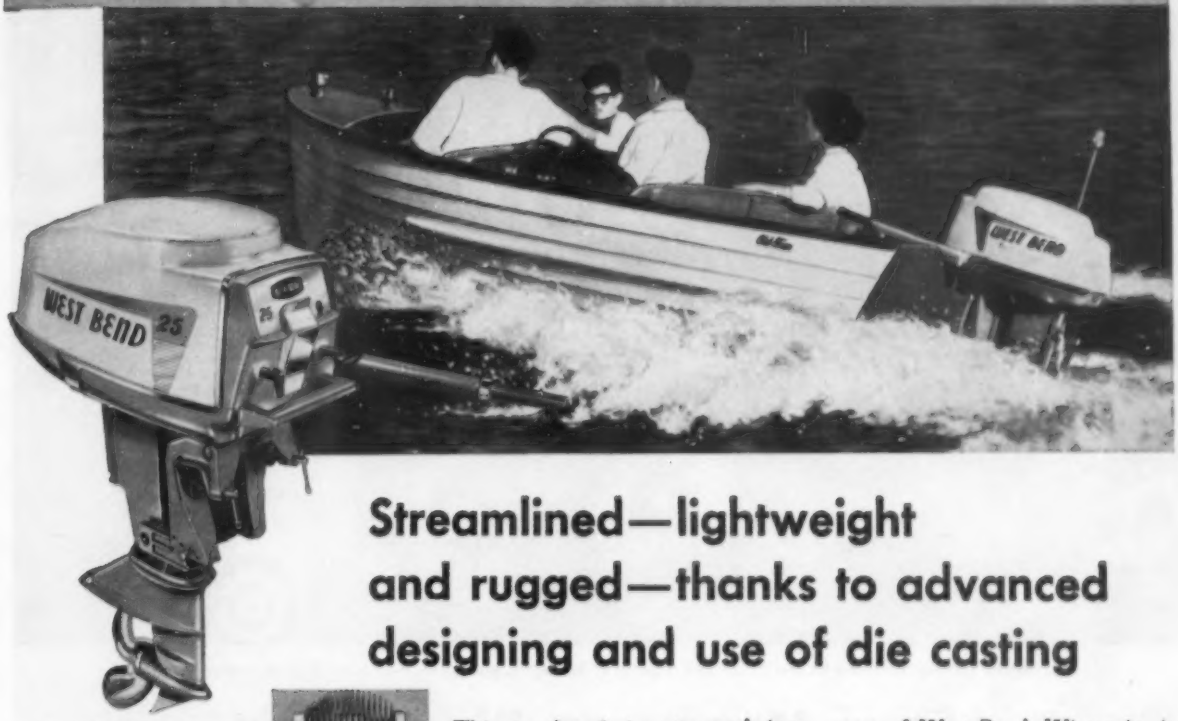
DRAFTING PRACTICES, both standard and simplified, are presented in an impressive 56-page manual available free from American Machine & Foundry Company. In its introductory section, Jay H. Bergen, AMF standards administrator, comments, ". . . Many people in industry including myself feel that the schools must teach what we consider to be standard drafting practice before a student is taught simplified practices. I feel that simplified drafting is a supplement and not a replacement for present-day practices."

Following the introductory statement of philosophy, the book contains 20 pages devoted to standard practices and 24 pages on simplified drafting. It includes Mr. Bergen's 11 rules for simplified drafting plus specifics of simplified practices.

Requests for the free booklet must be on company letterhead, addressed to the Public Relations Department, American Machine & Foundry Co., 261 Madison Ave., New York.

CHEMICAL MILLING of steel and titanium is being carried out at a new pilot plant set up by Turco Products, Inc. in a joint research and development effort with North American Aviation, Inc. It is similar to one previously set up by Turco for the chemical milling of aluminum. Weight reduction is one of the uses for this process, originated and patented by North American . . . it has been applied to taper sheets or extrusions, to reduce wall thicknesses of forgings and deep drawn parts. It is said not to impair the physical or mechanical properties of the metals appreciably. Precision contouring is another job accomplished by Chem-Milling.

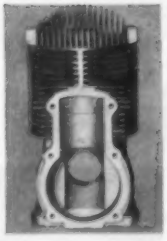
DIE CASTING REPORT



Streamlined—lightweight and rugged—thanks to advanced designing and use of die casting

4 cylinder sizes from one die!

Interchangeable cores in a master die enable Precision to produce 4 different sized aluminum cylinder blocks for West Bend.



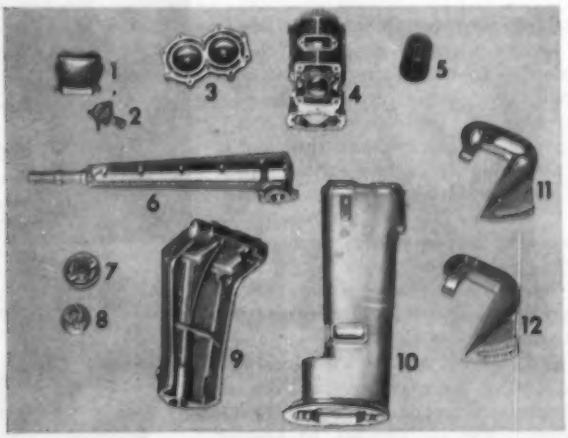
This year America's waters are being churned by a steadily growing outboard motor population. New companies entering this field have had to meet stiff competition from the "old line" producers. How have they done it?

The West Bend Aluminum Company, of West Bend, Wisconsin, is a good example. Their Hartford Division is currently putting on the market a line of high performance outboard motors ranging from 2 to 25 H.P. One of the most important factors in cutting down on excess bulk and weight has been the strategic use of aluminum die castings. Cooperative planning on die-cast design of components helped achieve compactness, streamlined appearance and light weight. All this without sacrificing strength where needed.

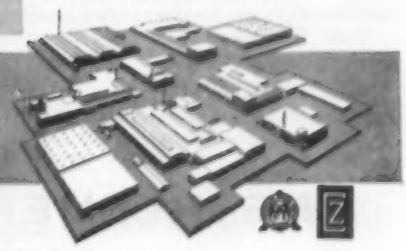
For production and assembly savings, it will pay *you* to investigate the use of die-castings. Let the Precision team of experienced die design engineers look at your problem. The result! Savings on machining, assembly and unit cost!

Typical Aluminum Outboard Motor Parts

1. Transfer port cover
2. Gas pump cover
3. Cylinder head
4. Cylinder block
5. Steel bushing insert
6. Steering handle
7. Bearing cage
8. Slip clutch plate adapter
9. Swivel bracket
10. Drive shaft casing
11. Stern bracket
12. Stern bracket



Write on your letterhead for free copy of "DIE CASTINGS . . . UNLIMITED" Precision Castings Co., 42 Warren St., Fayetteville, N. Y.



PRECISION CASTINGS CO.

A DIVISION OF **HARSCO Corporation**

FAYETTEVILLE, N. Y.—SYRACUSE, N. Y.—CORTLAND, N. Y.—NEW YORK, N. Y.
CHICAGO, ILL.—CLEVELAND, OHIO—KALAMAZOO, MICH.

For more information circle No. 52 on the Reader Service Card

This aluminum frypan is die-cast by dies of Cr-Mo-V (High V) at Stowe, Pa., plant of Doehler-Jarvis Division, National Lead Co.

Save Money on Die Casting with CR-MO-V (High V)

Looking for savings in manufacturing costs? Want long production runs for die castings made of lead, aluminum or magnesium? Use Cr-Mo-V (High V)—Bethlehem's 5 pct chrome-moly tool steel, with 1 pct vanadium.

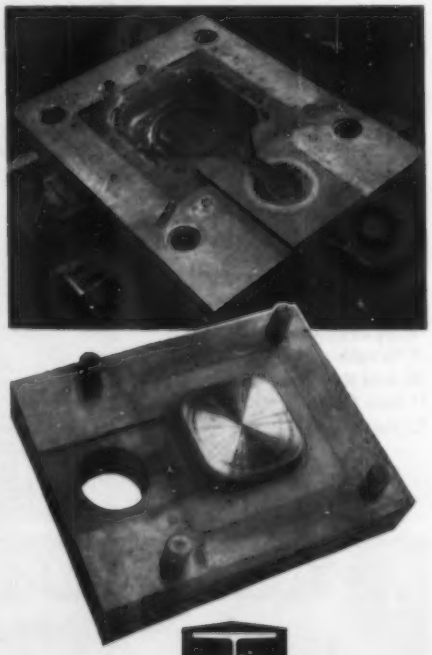
With Cr-Mo-V (High V), you get long, economical service where it counts—*before* the development of a fine network pattern of heat-checking. And when dies made of this fine tool steel are polished to a high lustre, they impart an exceptionally good surface to the casting.

Here's something else: Cleavage-cracking is no problem with Cr-Mo-V (High V), provided adequate radii are used in the die, and the steel is properly heat-treated. And because of its higher carbon content, plus high vanadium, this fine tool steel offers good resistance to surface-washing and erosion.

In making Cr-Mo-V (High V), we use proper melting procedure, plus adequate reduction of area in forging, thereby obtaining a steel with good grain refinement, uniform center density, and freedom from porosity and weak centers. Besides, this consistently high quality is always assured by means of ultrasonic testing.

For ease of machining, Cr-Mo-V (High V) is annealed to Brinell 217 max. It's steel that responds uniformly to heat-treatment, even in massive sections, because it has a uniform hardness of Rockwell C45-47.

Your Bethlehem tool steel distributor will be pleased to answer questions about Cr-Mo-V (High V). Or write to us at Bethlehem, Pa.



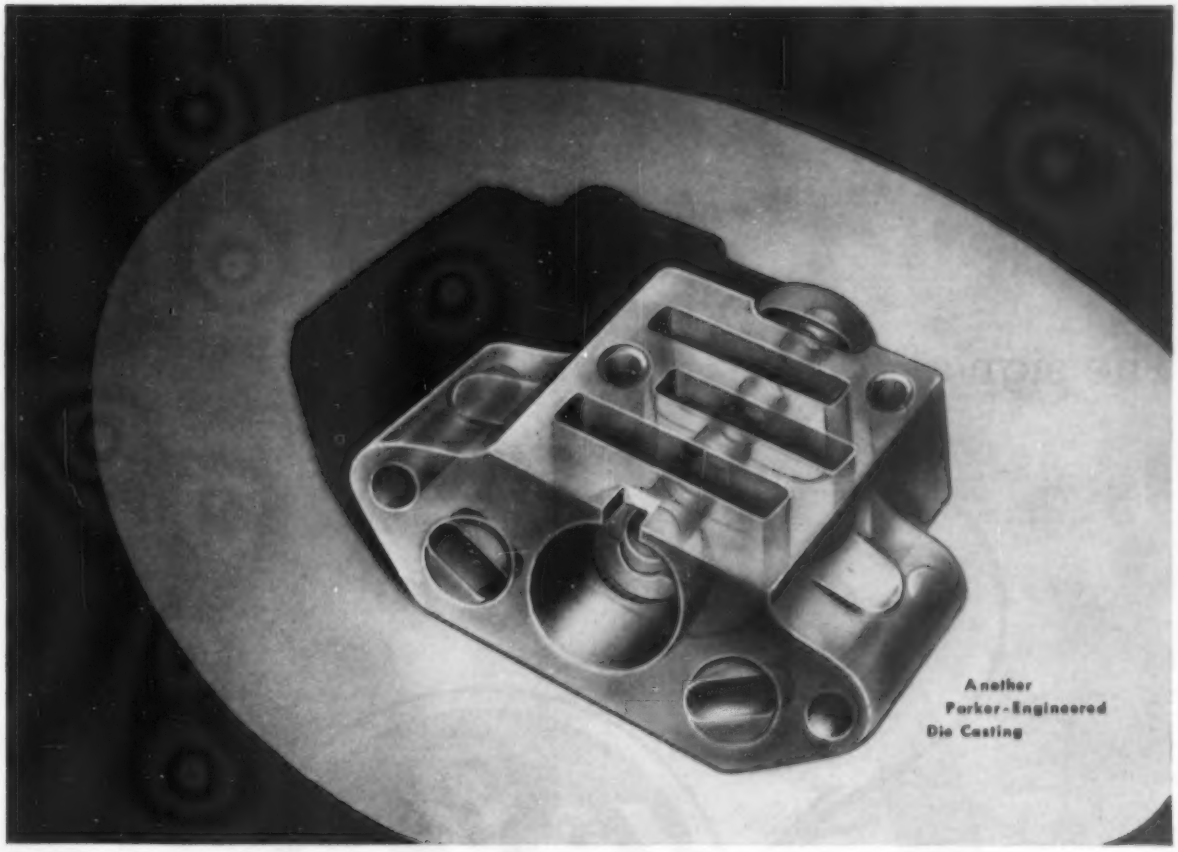
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEELS

BETHLEHEM STEEL

For more information circle No. 15 on the Reader Service Card



Another
Parker-Engineered
Die Casting

HOLES AND ALL . . . In One Casting Operation

PARKER SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Braxterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

Just imagine the savings effected by producing this intricate part *complete . . .* in *one casting operation.* Here, certainly, is dramatic proof of the skill, experience and creative imagination of Parker die designers. And when you add to these Parker-engineered cost savings other advantages such as high density, smooth as-cast finish and good tensiles, you can see why more and more design engineers are turning to Parker Die Castings for their component parts.

Parker has been a leader in die casting for 50 years—an old hand with new ideas. This skill and experience saves you money on *your* component parts. Just call the nearest Parker sales engineer or write the factory direct.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pennsylvania

PARKER

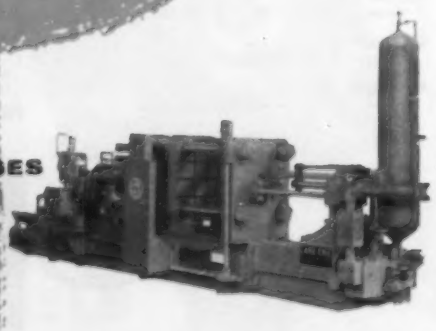
high pressure ALUMINUM and ZINC die castings
POWDERED METAL PARTS

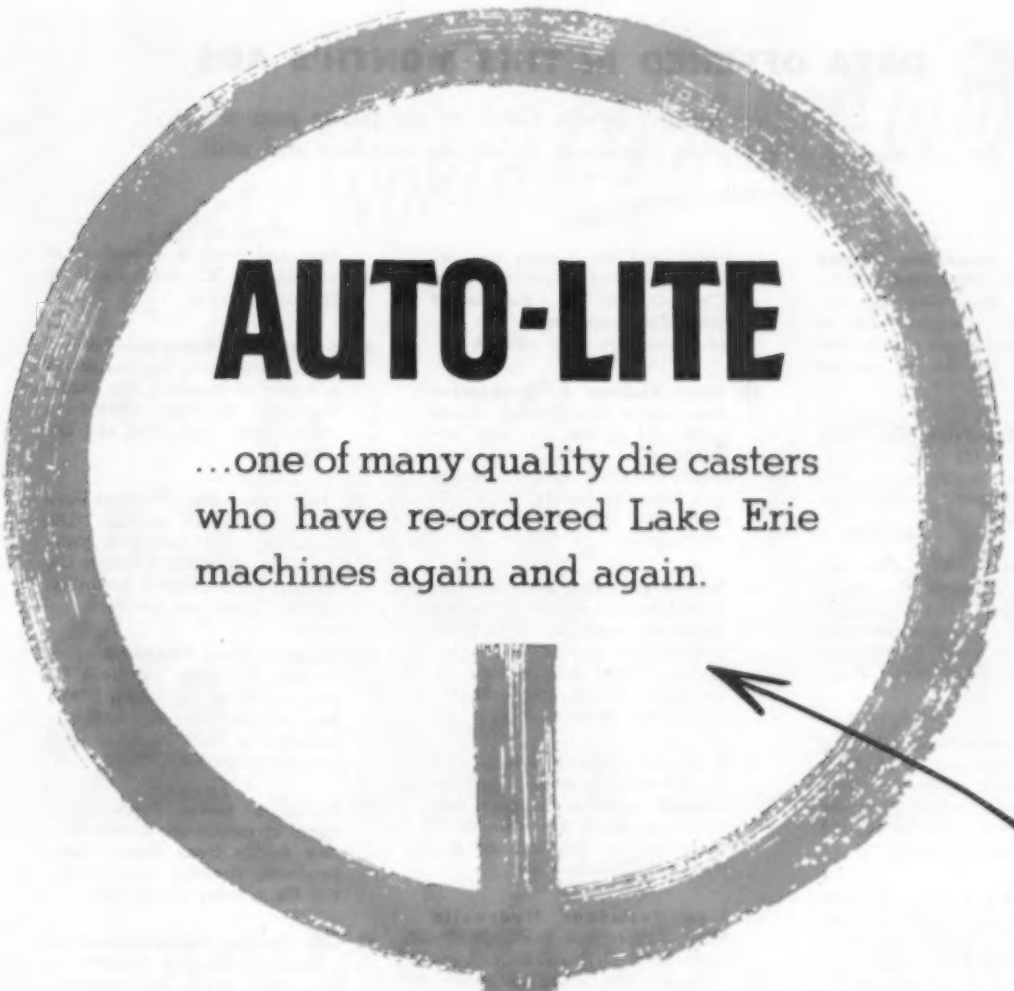
For more information circle No. 49 on the Reader Service Card

The sign of **QUALITY** in Die Casting Machines

LAKE ERIE

HOT AND COLD CHAMBER MODELS IN ALL TONNAGES





AUTO-LITE

...one of many quality die casters who have re-ordered Lake Erie machines again and again.

The sign of QUALITY die castings produced on 83 Lake Erie machines

"The (Continental) Mark II's grille is made by The Electric Auto-Lite Company, Toledo, Ohio. Ford engineers picked this company because it could maintain the quality standards they were seeking."

STEEL Magazine—May 28, 1956

LAKE ERIE®

LAKE ERIE ENGINEERING CORPORATION, 520 Woodward Ave., Buffalo 17, New York

For more information circle No. 79 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards on the facing page will get you these free reference materials. Circle the numbers and mail.

1. **Cast Alloy Steel Die Casting Supplies**—An illustrated bulletin from ACF Industries, Inc. describes their complete line of pots, castings, ingot molds, and goosenecks for the die casting industry.

3. **Colloidal Dispersions for Casting**—Bulletin 425 from Acheson Colloids Co. describes the different dispersions available for foundry use.

5. **Alloy Metal Powders**—The use of these powders in the fabrication of parts and the properties of the parts made from them are covered in detailed reports from Alloy Metal Powders, Inc.

8. **Heat Exchangers for Die Casting Machines**—Bulletin 1.1K5 from the Ross Heat Exchanger Div., of American-Standard gives the details of these units as applied to die casting machines.

10. **Die Casting Alloys**—A new booklet "Die Casting Alloys" has been issued by Apex Smelting Co. Mechanical and metallurgical properties of the as-cast alloys are given.

13. **Die Casting Machine Specifications**—The complete specifications on the different models of die casting machines now being built are given in literature from B & T Machinery Co.

16. **Common, Special Alloys Information**—The new bulletin from Cannon-Muskegon Corp. gives complete information on their vacuum-melted alloys of iron, nickel, and cobalt as well as special and rare alloys.

17. **Faster Die Set-Up**—that is also easier and safer is described in the latest catalog to be issued by Cast-Master, Inc.

20. **Universal Die Casting Machines**—that are said to be entirely new are described in model 400-N bulletin from The Cleveland Automatic Machine Co.

23. **Assistance in Aluminum Casting**—New aluminum applications in permanent mold, centrifugal mold, and die casting are revealed in information from Centr-O-Cast Co. Fabricating techniques and costs of the applications are also offered.

25. **Sprue Bushings & Spreaders**—Complete specification sheets giving all of the uses and advantages of specially designed, longer wearing sprue bushings and sprue spreaders are available from Detroit Mold Engineering Co.

27. **Improved Cutting Oil**—Bulletins describing the many lubricating specialties made by Fiske Bros. Refining Co. are available. One of the newest is a cutting oil for both ferrous and non-ferrous metal machining.

28. **Improved Metal Powders**—Resistox metal powders, said to produce superior bushings and structural parts are completely described in detailed reports from the Glidden Co.

32. **Fire Resistant Hydraulic Fluids**—Protective fluids are the subjects of informative literature discussing Houghto-Safe offered by E. F. Houghton & Co.

36. **Tilting Arc Melting Furnaces**—with a capacity of 15 pounds of steel and requiring only 12 KW are explained in a bulletin on the type PT Detroit Electric Furnace issued by Kuhlman Electric Co.

37. **Die Casting Machines**—in all capacities and for all castable metals are completely described in the new Kux Machine Co. illustrated catalog.

38. **Machines in Other Plants**—Information on their die casting machines now being used by various die casting companies is available from Lester-Phoenix, Inc. in their house organ, "The Lester Press."

39. **Designing Die Castings**—A booklet on design of parts to be die cast has been prepared by Litemetal Dicast, Inc.

40. **Melting Furnaces**—An improved electric resistance furnace for melting aluminum, magnesium, zinc and lead is described in bulletin No. 321 from Lindberg Engineering Co.

47. **Standard Bearings**—National Molded Products, Inc. has issued a listing of standard size bushings and bearings carried in stock. Sizes, load data, etc. are given.

52. **Uses For Die Castings**—are discussed in the booklet, "Die Castings . . . Unlimited" published by Precision Castings Co. Savings on machining, assembly, and unit costs are revealed.

53. **Stainless Steel Plunger Rings**—A special bulletin has been issued by Precision Piston Rings, Inc. on the properties and advantages of their stainless steel plunger rings.

55. **Powdered Metal Parts**—in a range of metals are shown in a new folder from Reese Metal Products, showing their facilities for powder metallurgy.

56. **Iron Powder Advantages**—Iron powder specifically tailored to give high green and sintered strength with controlled and reproducible dimensional changes is discussed in literature available from the Republic Steel Corp.

58. **Oil-Base, Fire-Resistant Fluid**—Test data and information has been released by Shell Oil Co. on Irus Fluid 902, an oil-base, fire-resistant hydraulic fluid which is being used as a direct replacement for hydraulic oils now in service.

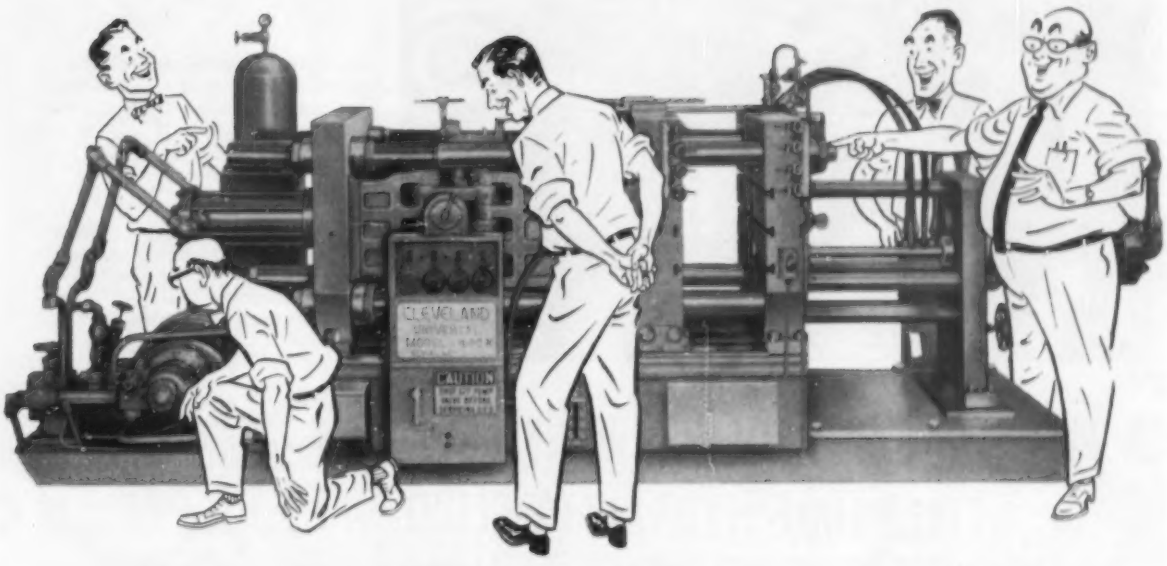
65. **Pilot Plant Casting**—In a new bulletin, DB-52-500, Westinghouse Electric Corp. discusses the facilities for pilot plant casting production and prototype manufacture in the new metals plant.

66. **Finishing Non-Ferrous Metals**—Detailed laboratory and engineering reports on the finishing of non-ferrous metals by the Iridite process are available from Allied Research Products, Inc.

Continued on page 18

WELL WORTH LOOKING INTO!

Cleveland Model 400-N shown with cold chamber end. Weight of metal per shot, including gate: 7.2 lbs., aluminum; 14.5 lbs., zinc.



New CLEVELAND model 400-N

Hydraulic Universal Die Casting Machine

Write for new Bulletin

From every angle, the new Cleveland Model 400-N has every feature you're looking for to give you better castings, faster, at less cost!

Here is a massively constructed, rugged, powerful machine. It locks dies at better than 400 tons pressure, *strain gauge tested*. Its faster die closing and opening speed will give you more shots per hour. Its rapid injection speed guarantees production of sound, dense, hardware-finish castings. Further, Cleveland's time-tested design and quality construction assure dependable, around-the-clock operation with machine maintenance at a minimum level.

Look into the new Cleveland Model 400-N, from every angle. You'll quickly discover why leading die casters call it the outstanding machine buy in its capacity range. Call in a Cleveland sales engineer for complete information and send for the new Model 400-N Bulletin.

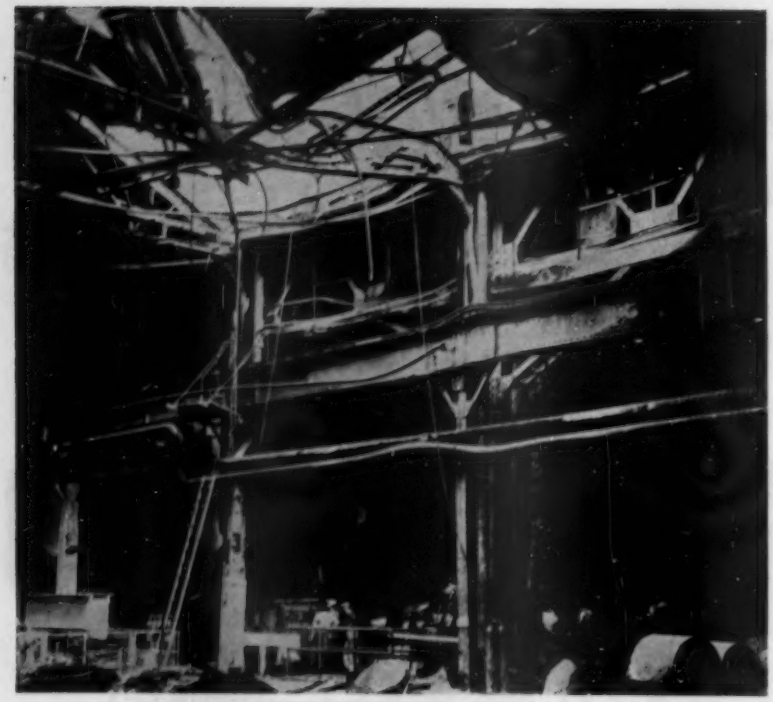
REMEMBER, CLEVELANDS CUT COSTS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

For more information circle No. 20 on the Reader Service Card



a costly way to learn you needed

FIREPROOF HYDRAULIC FLUID

Houghton Houghto-Safe hydraulic fluid would have prevented the fire that wrecked this plant. When a disaster like this happens, it isn't hard to point out exactly where fireproof hydraulic fluid should have been used.

But nobody wants to wait for a fire—and pay for fire damage—to find out where Houghto-Safe is needed. It's safer and much, much cheaper to figure it out this way—

Consider the pressures your hydraulic systems use. How far would fluid spray if a line breaks? Under even low working pressures, it could be 40-50 feet . . . or more! If there's ever hot metal, open flames, or other high temperature hazards within that radius, *you need Houghto-Safe.*

Houghto-Safe gives you complete fire protection with no loss of hydraulic efficiency. It has proved itself in some of industry's toughest hydraulic applications—as well as in hydraulic aircraft catapults on Navy carriers for the past two years.

Ask your Houghton Man for complete details—or write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

HOUGHTO-SAFE...a product of

E F HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

For more information circle No. 32 on the Reader Service Card

DATA IN ADS

continued from page 16

67. **Powder Coating For Metals**—Data sheets are available from The Chemical Corp. on their new Luster-On 50 powder for coating zinc or cadmium. Shipping economy and properties of the powder are listed.

68. **Painting With Masks**—Literature on spray masks, mask washers, automatic spray painting machines and clamps and fixtures is available from Conforming Matrix Corp.

70. **Cleaning & Barrel Tumbling**—compounds materials as well as the balance of the complete line are described in the latest complete catalog from the Frederick Gumm Chemical Co., Inc.

72. **Metal Polishing Wheels**—In their new booklet, "Setting Up Metal Polishing Wheels and Belts," the Norton Co. discuss their Alundum B abrasive wheels as to specifications, important features, and economy.

73. **Metal Cleaning**—and surface preparation are examined in a booklet "Some Good Things to Know About Metal Cleaning" that has been published by Oakite Products, Inc.

74. **Bright Gold Plating**—Details on the new gold plating process are given in literature that has been issued by Sel-Rex Precious Metals, Inc.

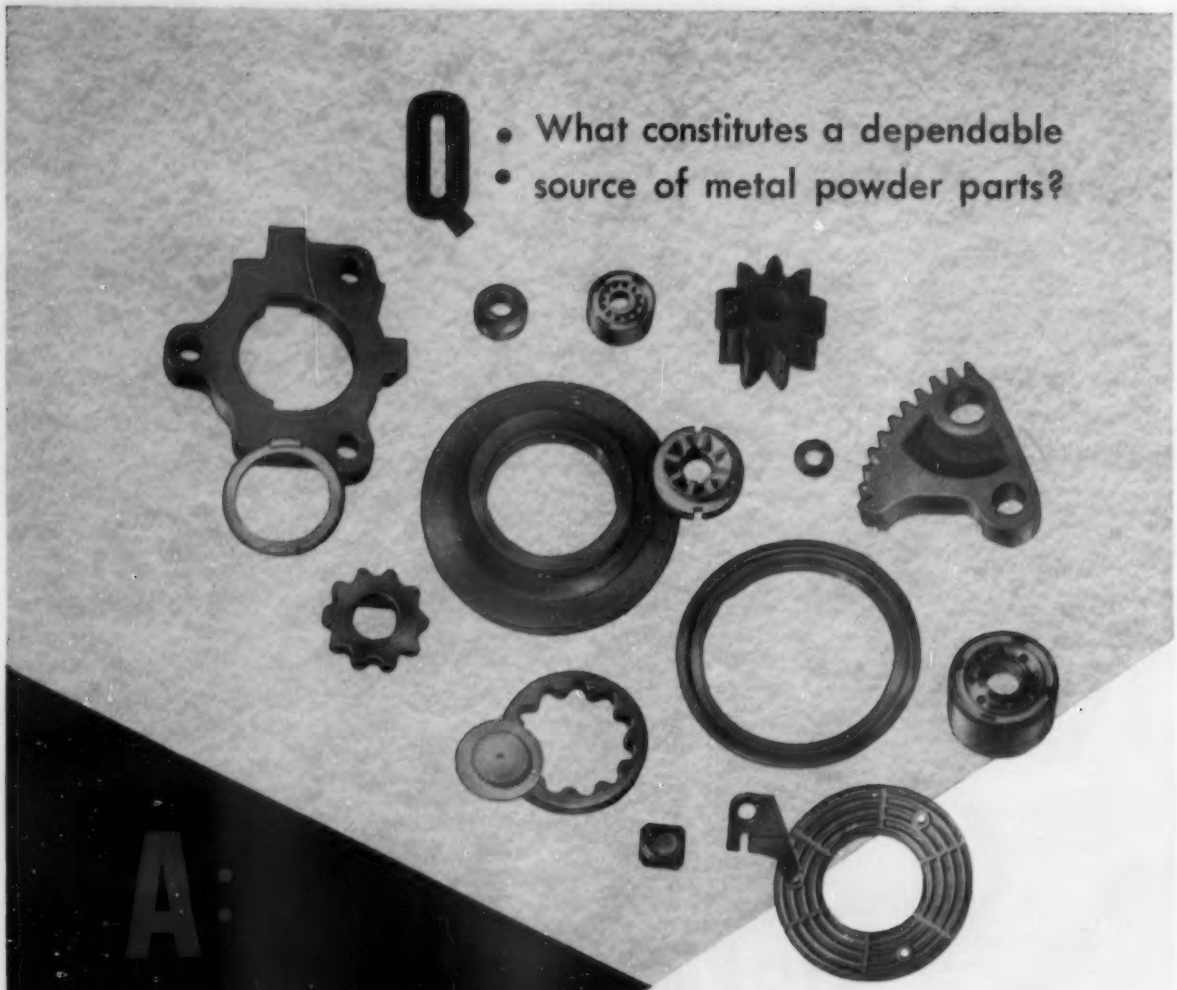
75. **1000 Shots Per Hour**—according to bulletin A-10, an engineering report on small die casting machines, from ABC Die Casting Machine Co.

76. **Barrel Finishing**—equipment, supplies and abrasives are all listed in the complete catalog from Esbec Barrel Finishing Corp.

77. **Cost Cutting With Die Castings**—A descriptive brochure has been issued by Paramount Die Casting Co. describing the facilities that are available to help cut costs through the use of die castings.

52nd
USCO
USCO K-Z
USCO K-Z Aluminum Die-Casting Alloy is a high zinc variation of the popular USCO K. In other words, USCO K-Z is an AXS-679 Revision 3 alloy with zinc up to 2% maximum. The physical properties of K alloy are retained in the K-Z alloy, at a price saving to you.
USCO K-Z, like all other USCO Aluminum Alloys, is production and quantometric controlled from raw materials to finished ingot under the most modern methods of alloying and refining—giving you the properties you desire in your castings.
As with all USCO Alloys, if you desire, K-Z can be tailor-made to fit your specific needs.
Let our metallurgical engineers, who have a practical working knowledge of die-casting, aid you in selecting the correct alloy and assist you with your melting and casting problems.
USCO
U. S. REDUCTION CO.
East Chicago, Indiana
PLANTS: EAST CHICAGO, INDIANA • TOLEDO, OHIO

For more information circle No. 62 on the Reader Service Card



Q • What constitutes a dependable • source of metal powder parts?

A: If the source is strong in experience, ability and good judgment —like Moraine Products—it cannot miss being dependable.

Moraine Products has the experience gained from the production of hundreds of millions of metal powder parts in an infinite variety of shapes and sizes. Moraine Products has the engineering and metallurgical ability to design parts for specific applications so that they can be produced most economically—usually in one press operation. And, finally, Moraine Products has the good judgment to recognize the limitations as well as the advantages of metal powder in each proposed application.

When we accept an assignment to make a part from metal powder, it is only after thorough conviction that our material and our process are best suited for the job the part will ultimately be expected to perform for the customer.

Moraine Products also produces: Moraine Power Brakes—Delco hydraulic brake fluids, brake assemblies, master cylinders, wheel cylinders, and parts—Moraine friction materials —Moraine-400 and M-100 automotive engine bearings—self-lubricating bearings and porous metal filters—rolled bronze and bi-metal bushings.

Another General Motors Value

Moraine Products

Division of General Motors, Dayton, Ohio

BETWEEN THE LINES

the editor's viewpoint on articles in current and forthcoming issues

POUR YOURSELF SOME POWDERED METAL, using a new version of an ancient process. Reported here are all the step-by-step details of a process for slip-casting stainless steel powder. The physical properties attained and the prospects for future developments are impressive. The report, by two scientists from Sylvania Electric's Atomic Energy Division, starts on page 40.

METALLURGICAL STANDARDS FOR DIE CASTINGS, as worked out by committees of the American Die Casting Institute, are of major importance to every designer of die castings. These standards on aluminum die casting alloys, covering both standard and special alloys, are published in this issue. Standards on other alloys will follow in subsequent issues of PMM.

SOME SPRAY IT HOT! The results when you apply paint to your castings hot are outstanding. We have put together a major report on all the technical and practical aspects of hot spraying, together with a detailed report on the experience of a major company now using it, will be featured in September's Finishing Section.

WE'RE SOLD OUT! Yes, inside of two weeks of publication, all extra copies of PMM's first annual Directory of Investment Casting were gobbled up. Apparently there was a real need for such a directory of the fast-growing investment casting industry. We ordered a large over-run of June issues to meet the expected demand, but judging by the interest, we're sorry we didn't order more copies. Well, the second directory next year is bound to be bigger and better and we'll try to order enough copies next time.

DO BUSINESS MACHINE MANUFACTURERS AGREE? Not always. Despite the fact that several of the largest manufacturers of this type of equipment use powdered metal parts to great advantage, there are some who have still not introduced any of this type of component except for standard bushings. PMM looked into this and came up with the conclusion that these companies are over-looking a way to improve their products and save money. The story will be a feature of PMM in September.

THIS PLUNGER RING CAN SAVE YOU MONEY ... TIME and Eliminate Lost Production

Precision UN-BREAKABLE TEMPERED and TREATED STAINLESS STEEL DIE CASTING PLUNGER RINGS

● The response to Precision's Stainless Steel Die Casting Rings has been tremendous. 75 new customers in 3 months. The reasons are obvious.

Precision Un-Breakable Plunger Rings are made of tempered and treated stainless steel. They are wrought, *not cast*, from dense, fine grain, flawless stainless steel. Engineered specifically for die casting machine applications, Precision Stainless Steel Plunger Rings give up to 8 to 10 times the average life of other rings. Produced under the most exacting methods, uniform tension and resiliency with long wearing, un-breakable and heat resistant qualities make it possible for plunger, groove and sleeve tolerances to be greater, thus eliminating unnecessary wear. Precision Rings are designed to allow for expansion under extreme heat and this feature with the characteristics of the stainless steel assures the finest, most dependable die casting plunger ring made.

Rings can be supplied in ¼" widths from 2¾" diameter up. They can be made to special diameters and widths.

Write for Precision's special bulletin on the stainless steel die casting plunger rings.

Precision's Engineering Department will gladly make recommendations on rings for your die casting plungers.

Precision PISTON RINGS, INC.

Sales Offices INDIANAPOLIS—CHICAGO—LOS ANGELES—SAN FRANCISCO—NEW YORK—PHILADELPHIA

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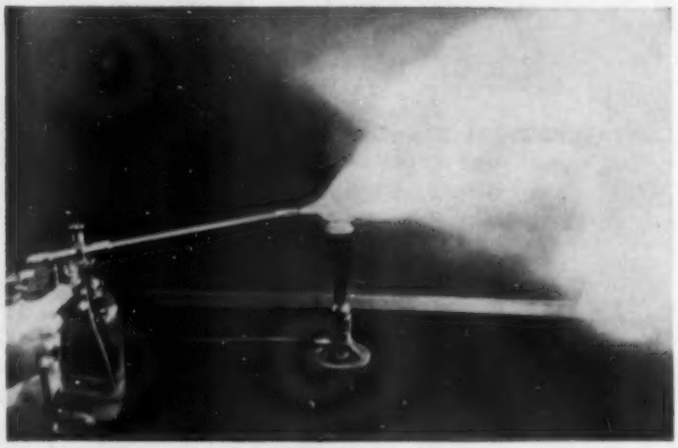
Announcing...the First

HYDRAULIC

Flame tests prove its fire-snuffing ability



This photo shows the instant combustion taking place when a conventional hydraulic oil of mineral oil type is atomized over a Bunsen burner.

In this photo, Shell Irus Fluid 902 replaces the mineral oil. Note that there is no ignition.

SHELL IRUS FLUID 902

Oil-Base fire-resistant FLUID

SHELL IRUS FLUID 902

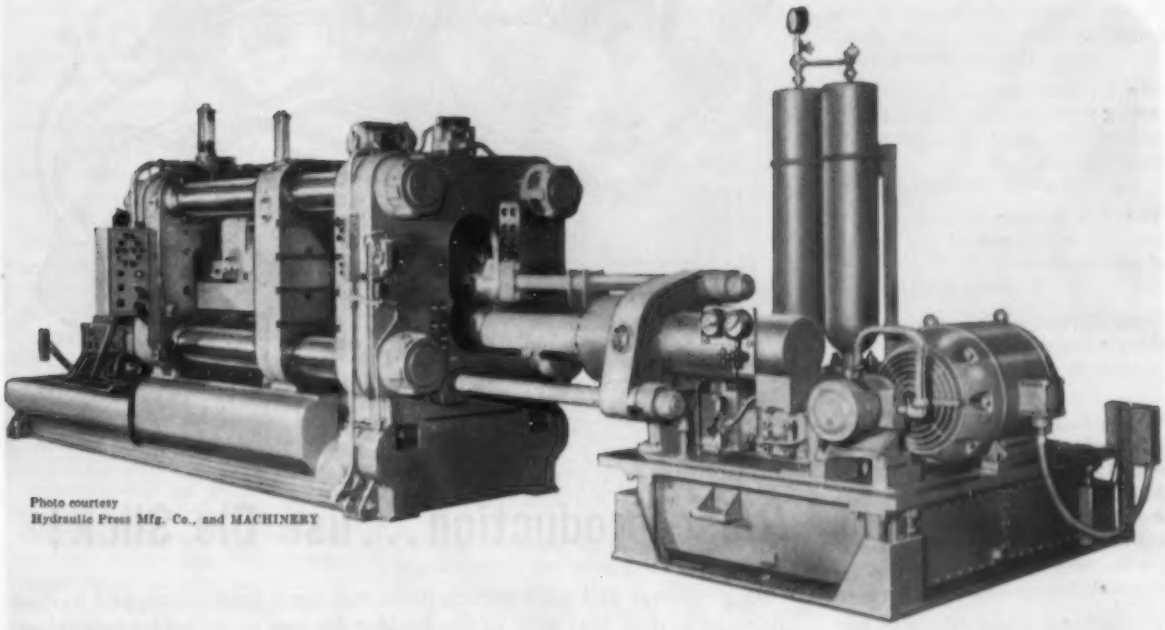


Photo courtesy
Hydraulic Press Mfg. Co., and MACHINERY

AFTER THREE YEARS of intensive research, field application and evaluation, Shell Irus Fluid 902 is now commercially available for use in industrial hydraulic systems. While its cost is far lower than other fire-resistant fluids, its performance is comparable.

No major modification of equipment is necessary. Shell Irus Fluid 902 is a special formulation containing no corrosive ingredients . . . no adverse effect on seals or fittings. It is a direct replacement for hydraulic oils now in service.

Noncorrosive, and nonrusting. Steel and copper panels immersed in Irus Fluid 902 for one week at 160°F have shown no significant signs of corrosion. Rusting has not been a problem in long-continued field tests.

This is an efficient fire-snuffing hydraulic fluid that can be widely used. Send coupon for details.

SHELL OIL COMPANY

50 WEST 50 STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

SHELL OIL COMPANY
50 West 50th St. New York 20, N. Y. or 100 Bush St. San Francisco 6, Cal.

Please send me test data and information on Shell Irus Fluid 902.

Name_____

Company_____

Address_____

_____

For more information circle No. 58 on the Reader Service Card

Die Slick case histories

"Your Die Slick No. 9 has enabled us to produce zinc castings with a cleaner and better surface finish."
Northern Iowa Die Caster

"With Die Slick our dies operate almost twice as long without cleaning due to practically no carbon formation on cores and ejector pins."
Large Chicago Manufacturer

"We are now casting a .405" wall casting which would not be possible without Die Slick. Thanks for a marvelous product."
Midwest Diecasting Jobber

"Die Slick has increased our production rate and improved the quality of our castings."
Michigan Manufacturer

"Your Plunger-Slick is the greatest plunger lubricant we have ever used . . . and we have tried them all."
Western Diecaster

"I have been with the pressure die casting business since its experimental stages and have tried everything imaginable to prevent galling and still get good surface finish . . . and can truthfully say Die Slick No. 3 is the very best."
Well-known Southern Diecaster

"On hardware jobs it (Die Slick #9) has shown a marked improvement on the finish of the castings."
Large Chicago Diecaster

"We are using Die Slick by the 55-Gal. drum because it keeps our scrap down to a minimum and our die cavities free from scale."
Large New Jersey Producer of Automotive Hardware

Raise production . . . use Die Slick!

Stuck castings and poor surface finish cut down production, and so does damage to dies. But 80% of the leading die casters no longer have these problems . . . they've discovered Die Slick, the lubricant that ends sticking, surface stains, and swirls. Among the six grades of Die Slick is one for every metal or alloy—zinc, brass, magnesium, aluminum, lead, or you name it. Plunger Slick, for cold chamber machines, lubricates sliding parts without breakdown under highest casting temperatures. Send for complete information, or better yet, order a week's supply for trial in your plant—we'll cancel the invoice if you're not satisfied. Be sure to specify the metal you are casting.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

DIE SLICK

used by die casters everywhere

G. W. SMITH & SONS, INC., 5403 KEMP ROAD, DAYTON 3, OHIO

For more information circle No. 59 on the Reader Service Card

PMM LETTERS

the readers' forum

FINISH FOR BAND INSTRUMENTS

Your article in the June issue of PRECISION METAL MOLDING on the New Non-Electrolytic plating process has been read with a great amount of interest. We are writing to the General American Transportation Corporation, whom you have listed as the process developer, for further information. We wish to make certain that our contact is made, so we are also writing to you for any further developments on this process which you may have.

From all appearances, we in the musical instrument business can use this process to a great advantage. If you have any further data on the process, would it be permissible for you to send it to us? — L.P.S. (Chief Engineer)

At least a half dozen major fields of application for the Kanigen process have been suggested to PMM's editor since the article appeared, but we must refer all inquiries to the Kanigen Div. of GATX. in Chicago who not only license other firms to operate under their patents, but also operate a large job finishing department. — Ed.

FOUNDRY IN FORMOSA

I am a mechanical engineer working in a national factory. I wish to improve the foundry work with plaster mold casting. Would you please give me any information about:

A. The formulation of gypsum plaster and other aggregates for bronze parts less than 2 pounds.

B. After casting, is the material of the plaster molds wasted or can it be recovered and used again? If it can be recovered how about the procedures for recovering? — A.C.J. (Formosa)

Full details concerning available formulations, procedures for mixing and pouring, and other data have been forwarded. The plaster cannot be used again and must be discarded. — Ed.

Continued on page 89

INCREASED PERFORMANCE

plus 34% COST REDUCTION on vital hay baler part!

Thanks to VASCO *Pre-Alloyed* STEEL POWDER

On this exacting agricultural machinery application*, the strength and toughness of VASCO Pre-Alloyed Steel Powders show to typical advantage. The powdered metal part (right) is a clutch dog that actuates the hay baling knotting mechanism, withstanding very high impact loads.

When engaged, the clutch dog drives the knotter from standstill to 70 rpm—a sudden impact repeated as often as six times per minute.

In accelerated wear tests, dogs made of VASCO 4630-A Steel Powder ran over 110,000 engagements with no sign of wear! Add to this a cost saving of 34% on the manufactured item, and you have still another example of a tough parts problem solved by VASCO high-strength steel powders.

Vasco Pre-Alloyed Steel Powders

Precise metallurgical control insures that each particle of *pre-alloyed* VASCO steel powder has the same analysis as the entire melt. This alloying by melting means that high tensile strength and other special properties can easily be developed by simple heat treatment. Standard pre-alloyed powders available from stock are AISI 304 and 316 Stainless, and 4630-A Alloy Steel. Other compositions are available for special requirements. Write.

*Name of manufacturer on request

Vanadium-Alloys Steel Company

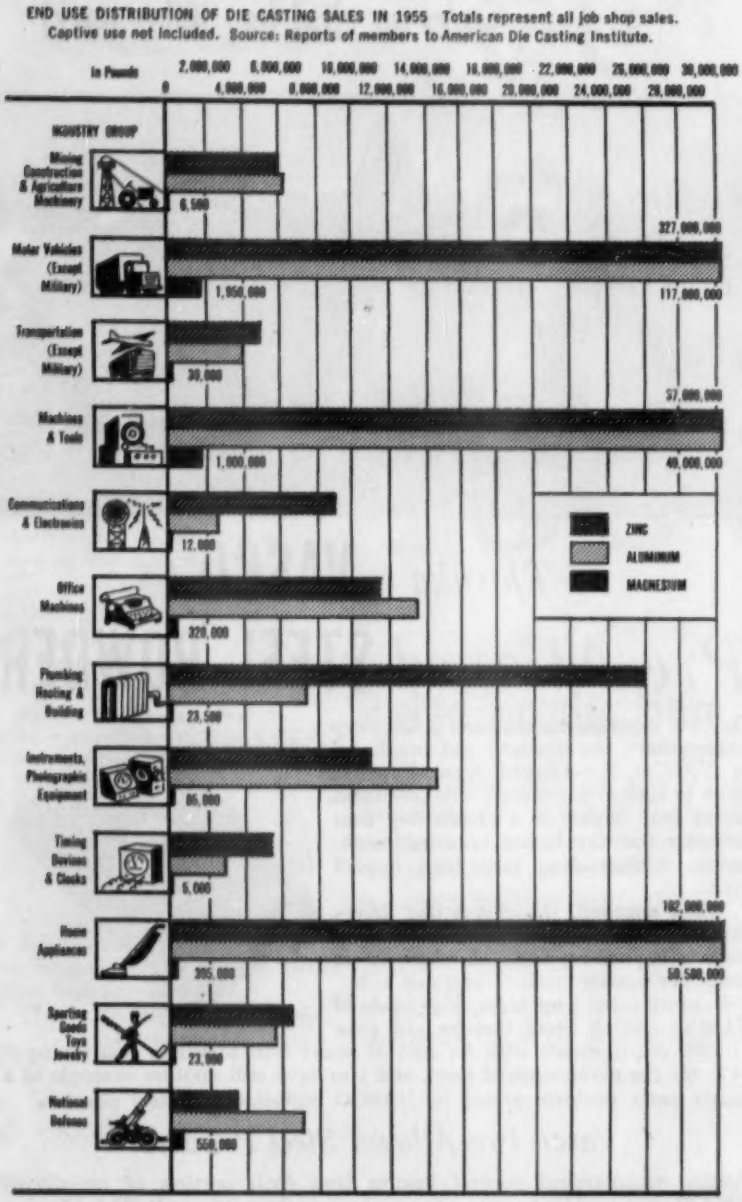
Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co.
Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

For more information circle No. 64 on the Reader Service Card

WHO BUYS DIE CASTINGS?

These Industries Do!



Last year set all-time high records for die casting production and sales. Substantial increases in the use of die castings by the industry's major customer groups indicates that when design engineers are faced with the competitive challenge of keeping quality high and prices low, more often than not the die casting process provides the solution.

Consumption of zinc for die casting is estimated at 410,000 tons – 40% of total slab zinc production. Shipments of zinc die castings by job shop, or custom, producers represented some 67% of the zinc die casting metal consumption totals. The balance represents captive production by end-product manufacturers. 99.99+% metal – which is the grade on which all zinc die casting alloys are based – exceeded any other grade in total consumption, displacing Prime Western last year for the first time in history. Most important of all, the use of zinc die castings increased in 8 of 11 industry groups. In industry's efforts to keep quality high and prices low, the relatively young die casting process has become a major factor. It is inevitable, therefore, that the consuming industries will require more and more Special High Grade Zinc. As pioneers in its production, Bunker Hill is now taking steps to make greater tonnages of 99.99+% metal available.

DIE CASTING is the Process • ZINC, the Metal
BUNKER HILL, the Preferred Zinc

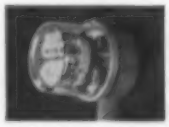
BUNKER HILL 99.99+% ZINC

EASTERN SALES AGENTS **ST. JOSEPH LEAD COMPANY** 250 PARK AVENUE, NEW YORK 17
SALES OFFICE FOR PACIFIC COAST **NORTHWEST LEAD COMPANY** SEATTLE, WASHINGTON

MORE DIE CASTING - LESS SCRAP

New H-P-M Ups Production For Basic Aluminum Castings Co.

"By moving several jobs from a conventional toggle type machine to our new H-P-M, we reduced scrap loss to a minimum . . . at the same time we increased production." This report from T. M. Byrne, President, Basic Aluminum Castings Co. of Cleveland is typical. H-P-M die casting machines are doing an outstanding job for die casters throughout the country and here are the reasons why: They are designed to entirely new theories of metal injection and clamping. The new exclusive hydraulic-mechanical link-wedge clamp has plenty of "beef"—clamp locks die firmly to rated capacity and better. "Beef" limits die parting on overload during metal injection. Results—flash and scrap loss reduced to a minimum . . . quality parts produced to accurate dimensional tolerances. The new injection end has unlimited plunger motion control . . . exceptionally high speed. Call in an H-P-M engineer today and let him give you the complete facts before you buy. You'll be glad you did.



Watthour meter socket cast in a single cavity die on an H-P-M 400-ton die casting machine at Basic Aluminum Castings Co. This is a 1½ pound shot. Production—140 an hour.

DIE CASTING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

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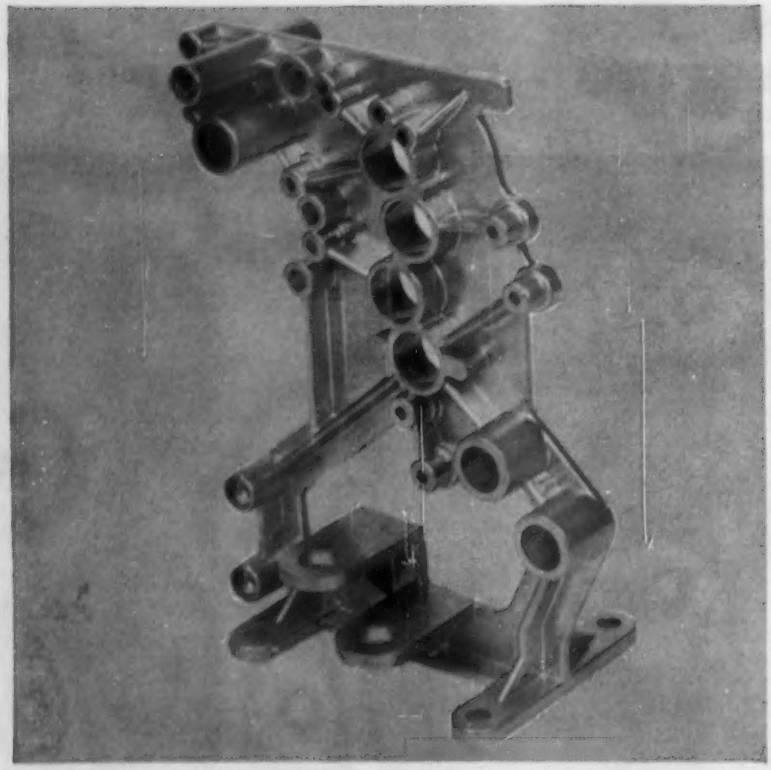


What other process could do it so well?

All things considered, there's really only one *best* way to produce this chassis for an electric computer.

When you figure that it must be built at the lowest possible unit cost, must use a production method that is highly flexible to accommodate the unusual shape, and must maintain a variety of close tolerances . . . only die casting *could* do the job.

Also, working closely with Twin City engineers, this manufacturer *designed* for die casting to get the maximum out of the process. By thinking in terms of die casting right from the drawing boards he eliminated many production and finishing jobs, saved on unit costs, saved on machining.

Possibly you're producing a part by some more costly, less flexible, less accurate process than die casting. If you think that might be true, contact Twin City Die Castings Company. Twin City engineers can probably save you money. They have for hundreds of customers.

...only DIE CASTING can

✓ cut your costs

✓ offer such flexibility

✓ provide such accuracy

FOR PROOF... CALL, WRITE OR WIRE:

TWIN CITY DIE CASTINGS CO.

3351 TALMAGE AVENUE S. E. • MINNEAPOLIS 14, MINNESOTA

TELEPHONE MIDWAY 6-7528

For more information circle No. 61 on the Reader Service Card

PMM PEOPLE

changes & appointments

Charles W. Burkland has been appointed to the newly-created position of associate research engineer in *The Maytag Co.'s* research and development division.

Allied Research Products, Inc. has announced the appointment of **Jack Gabrielson** as representative in the northern Chicago territory. **Frank Bryant** has moved to Chicago to cover the south Chicago, southern Illinois, and Indiana area. **Arthur Jackson** will take over the Iowa-Nebraska-western Illinois territory, formerly handled by Mr. Bryant.

Crucible Steel Co. of America has appointed **Kenneth M. Acton** as manager of its San Francisco Sales branch, according to **J. D. Glenn**, vice president and general manager of sales. Mr. Acton was formerly assistant manager at the west coast branch.

Esbec Barrel Finishing Corp. recently announced the appointment of **Illinois Deburring Co.** as northern Illinois representative for Esbec equipment.

Joseph F. Sullivan, Jr. has been named plant manager of *Utilex Mfg. Co.*, a subsidiary of *Universal Die Casting and Mfg. Corp.* Mr. Sullivan was formerly chief industrial engineer at Universal.

Edward L. Dreyer, director of research and development for *Adamas Carbide Corp.*, has been appointed to the post of works manager. **Michael J. Kaiola** joins the firm as production manager.

Dr. Robert K. Smith has been appointed manager of research for *E. F. Houghton & Co.*

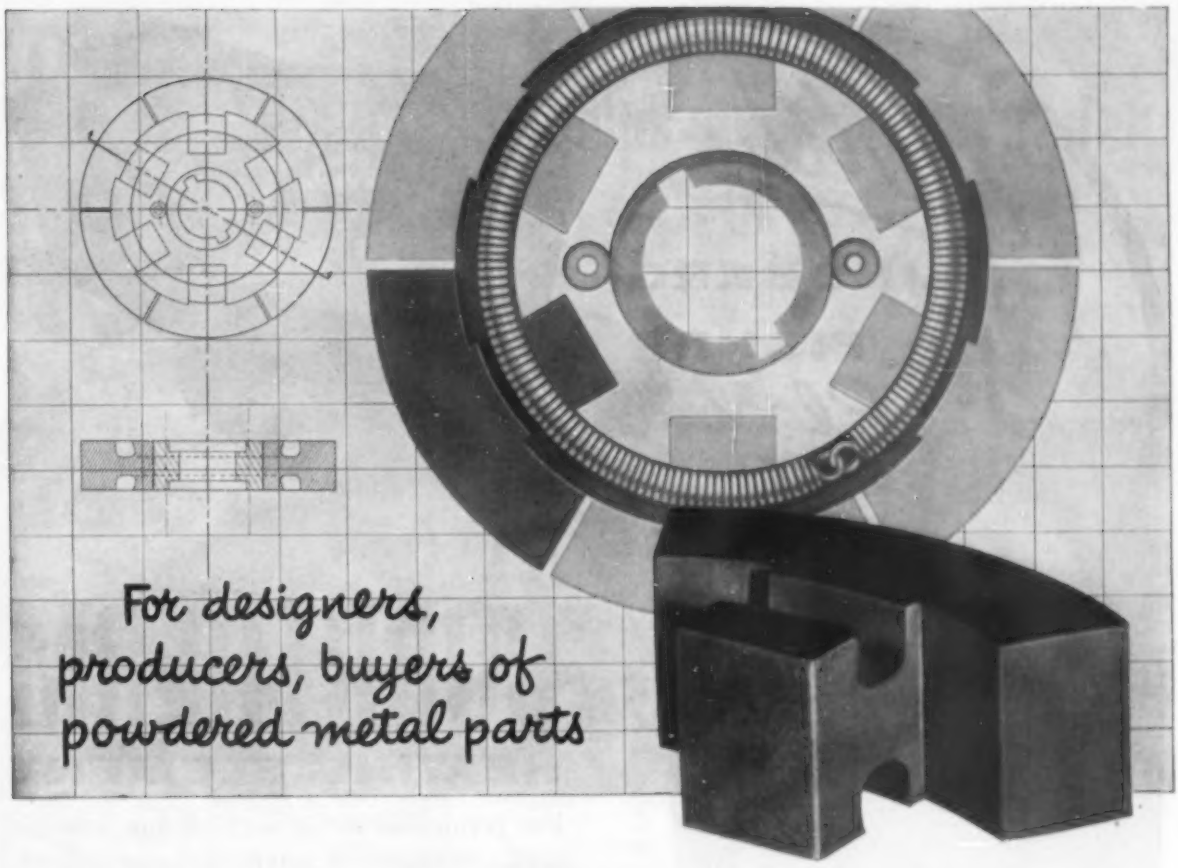
Kelite Products, Inc. has appointed **Albert W. Lupien** as regional vice president and **G. Stuart Krentel** as manager of technical sales service for its western region.

Harry P. Barrand has been elected to the board of directors of *Hanson-Van Winkle-Munning Co.* The company also named **Paul A. Waalkes** as assistant manager of compound sales.

The appointment of **Edward J. Vargo** as plant manager of *Alloy Precision Castings Co.* has been announced by Frank W. Glaser, executive vice president and general manager of the company.

Jarvis Corp. has announced the appointment of **George J. Carvalho** as general manager of its *Jarvis Power Tools, Inc.* division.

Continued on page 33



Republic Iron Powder offers these advantages

FOR DESIGNERS—Republic Iron Powder has good green and sintered strength to aid you in attaining design goals of projected or production items. Uniform shrinkage and growth characteristics help you in die design and in establishing the finish dimension of parts.

FOR PRODUCERS—Republic Iron Powder is uniformly consistent in lot after lot. High green and sintered strength and lower briquetting pressures reduce your processing and handling problems. Republic's hydrogen reduction process has established acceptable limits on flow rate, hydrogen loss and chemical analysis. Particle size distribution and apparent density are carefully controlled.

FOR BUYERS—Republic is working closely with many leading producers of iron powder parts—exchanging ideas and information on how to make parts faster, more uniform and at minimum cost. And, how to make complicated shapes which are difficult to produce economically by other methods. We shall be happy to share this wealth of information with you or put you in touch with these fabricators.

So, whatever your requirements—designing, production or buying—Republic Iron Powder can help you. Our metallurgists and engineers are available for consultation without obligation. Just send the coupon.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-1763
3192 East 45th Street
Cleveland 27, Ohio

☐ Please send more information on Iron Powder.
☐ Have an engineer call.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

For more information circle No. 56 on the Reader Service Card

now...

LINDBERG-FISHER *Electric* **RESISTANCE FURNACE WITH...**

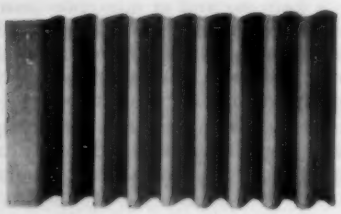
CORRTHERM

HEATING ELEMENT

For permanent mold, sand casting, and die casting of aluminum, magnesium, zinc and lead, Lindberg-Fisher now offers its improved Electric Resistance Furnace with the revolutionary new CORRTHERM Heating Element.

Lindberg-Fisher ER Furnaces have, time and again, meant lower cost per lb. of finished casting. And with practically indestructible CORRTHERM elements, lower furnace maintenance costs and longer crucible or pot service assure you of even greater savings.

These furnaces eliminate localized heating of metal, and gas absorption, because no products of combustion are present. No exhaust fumes or smoke means less operator fatigue and higher production. Investigate the advantages of this furnace. Write for Bulletin No. 321.



CORRTHERM elements are large sheets of nickel chromium. They are easy to install, just hang in furnace, and operate at extremely low voltages, completely eliminating shock or short hazards.

LINDBERG FISHER **MELTING FURNACES**

A Division of Lindberg Engineering Company

2463 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS

For more information circle No. 40 on the Reader Service Card

3 ways Glidden helps you produce better METAL POWDER PARTS

Superior metal powders — Glidden Resistox Metal Powders have been subjected to the most exhaustive tests by parts manufacturers. Result: parts made from Glidden metal powders are judged superior to parts produced from other powders. They permit faster production, with greatly improved finish, appearance and performance characteristics.

Complete field service and lab facilities — Whether you are interested in establishing a new metal powder parts department, or desire to improve operations of an existing department, Glidden can help you. The Glidden metal powders lab and the services of Glidden technicians are available to your metallurgists at any time.

World's largest blender — Glidden can produce up to 30,000 pounds of powder in one batch, more than any other producer... an important factor in complete uniformity of mass-produced parts.

A thorough examination of the manufacturing methods you are now using may lead to substantial savings. Make certain you are not passing up the economies, speedier fabrication and superior parts performance you can get by using Glidden Resistox Metal Powders. Write for complete details.

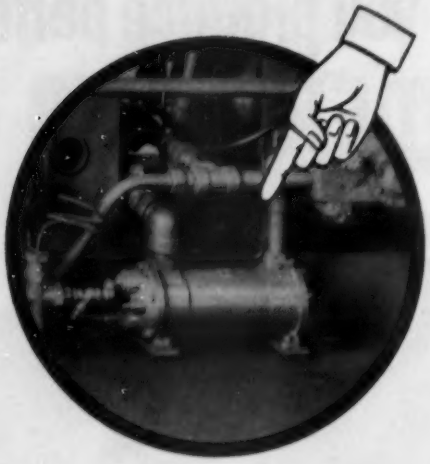
THE GLIDDEN COMPANY

Chemicals — Pigments — Metals Division

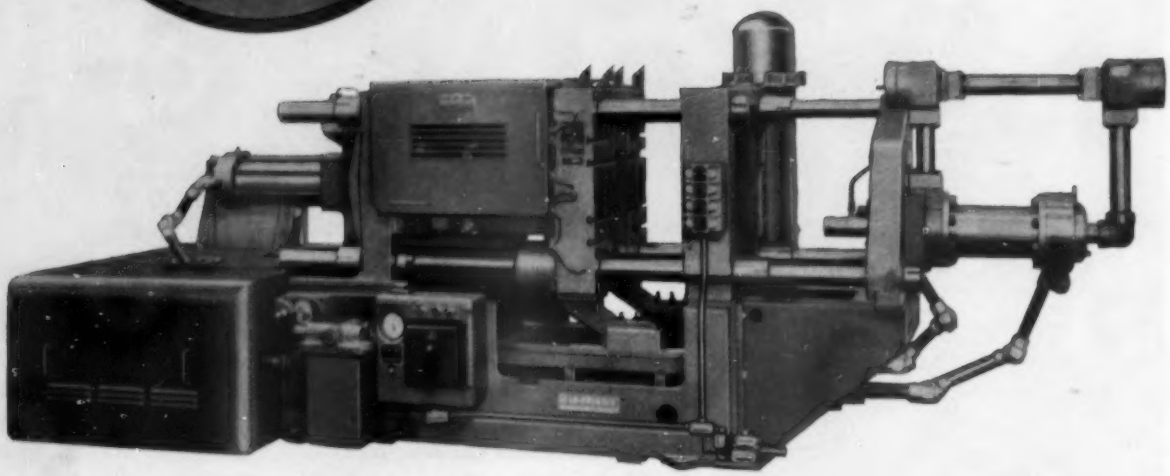
Baltimore, Md. • Collinsville, Ill.
Hammond, Ind. • Scranton, Pa.

For more information circle No. 28 on the Reader Service Card

equipped with a ROSS EXCHANGER



this Reed-Prentice Die Caster puts a high pressure squeeze on every shot



Featuring a "Hi-Speed, Hi-Pressure" Plunger operating at 10,000 ipm, this 400-ton Reed-Prentice Die Casting Machine applies a final high pressure squeeze to produce extra-dense aluminum and magnesium castings.

To insure full locking tonnage on every shot, a Ross Type BCF Exchanger is used to keep hydraulic oil temperature in check. With continuous cooling thus assured, there can be no overheated, thinned oil to cause pump slippage.

Preferred by hydraulic machinery builders and users alike, Ross Exchangers are ruggedly built to withstand punishing hydraulic shock. Tough, ductile seamless shells can well absorb the extra load.

Compact in design, Ross Exchangers are pre-engineered and fully standardized in a wide range of sizes to answer your needs. For more information, request Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS

ROSS HEAT EXCHANGER PRODUCTS

For more information circle No. 8 on the Reader Service Card

PEOPLE

continued from page 28

Acheson Colloids Co. recently announced the addition to its staff of **Theron T. Chapel** as product control supervisor and **James S. Crowl** as supervisor of process research. Mr. Crowl replaces **Erwin J. Campbell** who has been named product development supervisor for the company.

Frank L. Merwin has been named general traffic manager and **George W. Cantwell** has been appointed traffic manager at the New York City offices of *American Smelting & Refining Co.*

William E. Sauter has been appointed assistant to the president of *C. I. Hayes, Inc.*

Minneapolis-Honeywell Regulator Co. named **Glenn E. Seidel** to the newly-created corporate position of vice president in charge of engineering. Mr. Seidel had been vice president in charge of engineering in the firm's Minneapolis plants.

Leonard W. Kates has been named manager of commercial development for the *Atomic Energy Division of Sylvania Electric Products, Inc.*

The appointment of **Edward C. Williams** as manager of customer relations has been announced by *The Wellman Bronze & Aluminum Co.*

Raybestos-Manhattan, Inc. has announced appointments to four positions at its *Wabash Division*. **Clarence P. Schneider** has been named general manager and **Norman L. Caldwell** has been appointed factory manager. **Dr. Ben T. Collins** has accepted the position of director of research and product development and **LeRoy Musselman** has been named division comptroller.

Romus A. Lula, research supervisor for *Allegheny Ludlum Steel Corp.,* has been named associate director of research—stainless steel at the company's Breckenridge, Pa. research laboratory.

Bruce M. Sheffer was recently appointed manager of advance manufacturing engineering at the *General Electric Co.'s* carboloy department.

Robert R. Stough has been appointed sales engineer for *Precision Metalsmiths, Inc.* Mr. Stough will cover the northeastern Ohio territory.

Rem-Cru Titanium, Inc. announced that **Dr. Russell C. Buehl** has joined the company's staff to study and develop new melting techniques for titanium alloys.

Charles G. Rigdon has been appointed to the newly-created position as barrel finishing engineer for *Frederic B. Stevens, Inc.*

For more information circle No. 55 on the Reader Service Card

POWDERED METAL PARTS BY Remet

We can reduce your costs and improve your product with the advantages of the powdered metal process. Our modern plant and technical facilities are at your disposal to meet your most exacting parts requirements. Your inquiry is solicited for study and quotation.

WRITE FOR FREE FOLDER

Remet

REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Pa.

TYPICAL PARTS:
Gears, pinions, cams, ratchets, bearings and bushings, machine and structural parts.

SPECIAL, high speed rotary presses available for high quantity, small part production

Will Last MONTHS Instead of HOURS

AUTO-DIESEL Plunger Rings have lasted OVER 122 DAYS

A set of Auto-Diesel Steel Plunger Rings have lasted over 122 days—they were immersed in molten zinc over 800 hours. THEY ARE GIVING OVER 100,000 SHOTS PER SET IN MANY PLANTS. (Names furnished upon request). Made of cast iron, dialoy cast iron or hardened steel, especially for those operating die casting machines or casting zinc parts. It will pay for you in dollars and cents to investigate. Write today.

AUTO-DIESEL 2 or 3 Piece Plunger Segment Rings Reduces DOWN-TIME

Down-time costs money in many ways. It can be reduced along with expensive repairs by using Auto-Diesel 2 or 3 piece Plunger Segment Rings. Made of high grade wear resisting iron in sizes from 1½" to 4" for hot chamber die casting machines.

Write for Details

THE AUTO-DIESEL PISTON RING CO.
3135 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

For more information circle No. 11 on the Reader Service Card

Cannon-Muskegon protects your product's quality . . .

because MASTERMET alloys more than meet your most exact specifications

MASTERMET alloys are premium materials compounded to improve your product . . . *at no extra cost.* Alloys are made from *prime materials only* . . . then alloyed under exact time and temperature control. The latest degasification methods assure a clean, sound product.

What's more, MasterMet alloys are made to *compensate for your melting losses* . . . their chemistry meets all similar specifications.

Finally, Cannon-Muskegon *cleans* alloy of surface oxidation . . . which means less trouble for you. And with each lot you get *certification* of exact chemistry — there's no guesswork. In addition, MasterMet alloys are packed in easy-to-handle, clearly marked containers to simplify selection and storage.

But MasterMet alloy service is not over until the casting has left your shop. Cannon-Muskegon offers expert consultation service to assist you in improving your processing methods and, ultimately, your product.

Next time, call Cannon-Muskegon for your alloy needs — you'll be glad you did!

NOW . . . UltraMet VACUUM-MELTED ALLOYS

Cannon-Muskegon now offers vacuum-melting facilities for the production of iron-, nickel- and cobalt-base alloys up to temperatures of 3100°F . . . and special alloys for industry . . . in ingots or cast billets. We are ready to provide cleaner, stronger and more ductile alloys for remelt . . . sample development and production of vacuum process castings . . . and cast ingots for forging, extruding or machining.

MasterMet ALLOYS AVAILABLE

You can get immediate delivery of high alloys including cobalt- and nickel-base alloys, chromium and chromium-nickel stainless steels. Special alloys include Monel*, Inconel*, Ni-Resist* and Invar — and rare alloys including types with titanium and columbium additions blended to meet your special needs . . . in ingot, shot, billet or cast bars . . . packed in convenient, clearly marked drums. Ask for our "in-stock" list.

Get complete information on MasterMet and UltraMet alloys and services . . . write for New Bulletin.

MASTERMET CERTIFIED ALLOYS FOR INDUSTRY

*(R) International Nickel Corporation

CANNON-MUSKEGON CORPORATION

2871 Lincoln Street — Muskegon, Michigan, U.S.A.

METALLURGICAL SPECIALISTS

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PMM PATENTS

Copies of all patents reviewed can be secured from U. S. Patent Office, Dept. of Commerce, Washington, D. C. for 25¢ each.

A METHOD OF MAKING SHELL MOLDS. Mold components are made by coating a pattern with a refactory material mixed with a thermosetting plastic which acts as a bonding agent for the refractory material. The pattern is made of a material having a melting point between the bonding temperature and the thermosetting temperature of the plastic. In making the mold, the pattern is coated with a dry mixture of the plastic and refractory material. The coated pattern is heated to a temperature to cause bonding of the particles of refractory and there-after heated to the thermosetting temperature. The pattern is removed in liquid form from the built up mold.

Patent No. 2,736,077 — Kenneth M. Bartlett — assigned to Thompson Products, Inc. — issued February 28, 1956.

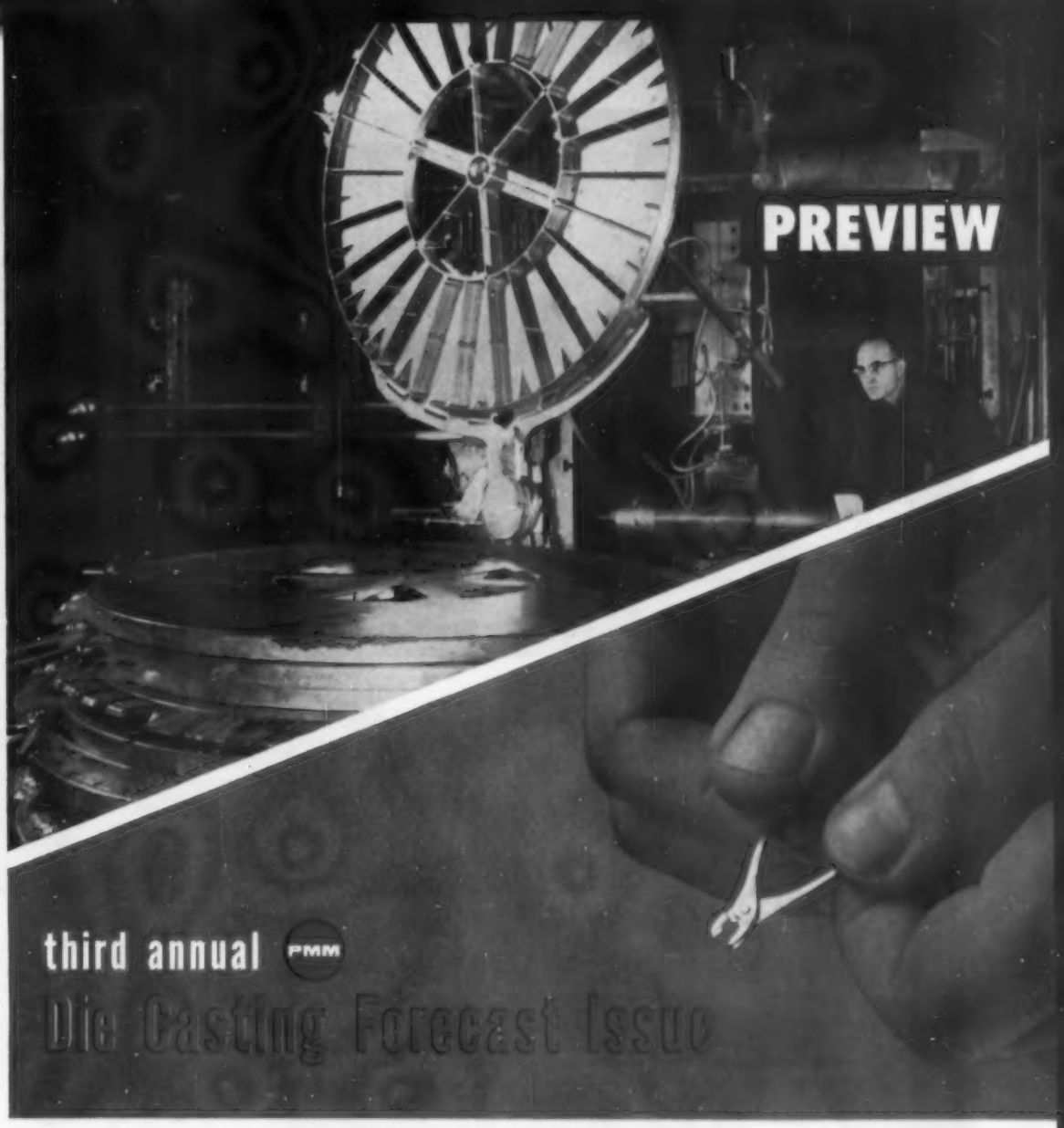
CORROSION RESISTANT TITANIUM CARBIDE ARTICLES. Preshaped bodies composed of from 40% to 60% by weight of titanium carbide and the balance at least 10% and up to 30% chromium, 4% to 5% cobalt and the balance nickel. Mixed powders are presintered at a temperature below 1300 C, shaped and then resintered at a temperature above 1300 C. Such bodies are resistant to corrosion in oxidizing gases at elevated temperatures and exhibit high strength at elevated temperatures.

Patent No. 2,736,086 — Thomas Raine — assigned to American Electro-Metal Corp. — issued February 28, 1956.

PRODUCTION OF METAL BORIDES. A method of producing a substantially pure powder mixture consisting of a refractory metal boride and boron. A metal hydride from the group of zirconium, titanium, vanadium, chromium, tungsten, molybdenum and mixtures of these metal hydrides is mixed with essentially pure boron. The powdered mixture is compacted and heated at an elevated temperature to decompose the metal hydride. The heating is then continued at a higher temperature to cause the metal formed to combine with the boron. Still further heating at a higher temperature removes most of the impurities that may be present. The compact thus formed is a mixture of the metal boride and boron. The compact may then be disintegrated to give particles of uniform and homogeneous composition.

Patent No. 2,735,155 — Frank W. Glaser — assigned to the Borolite Corp. — issued Feb. 21, 1956.

Continued on page 37

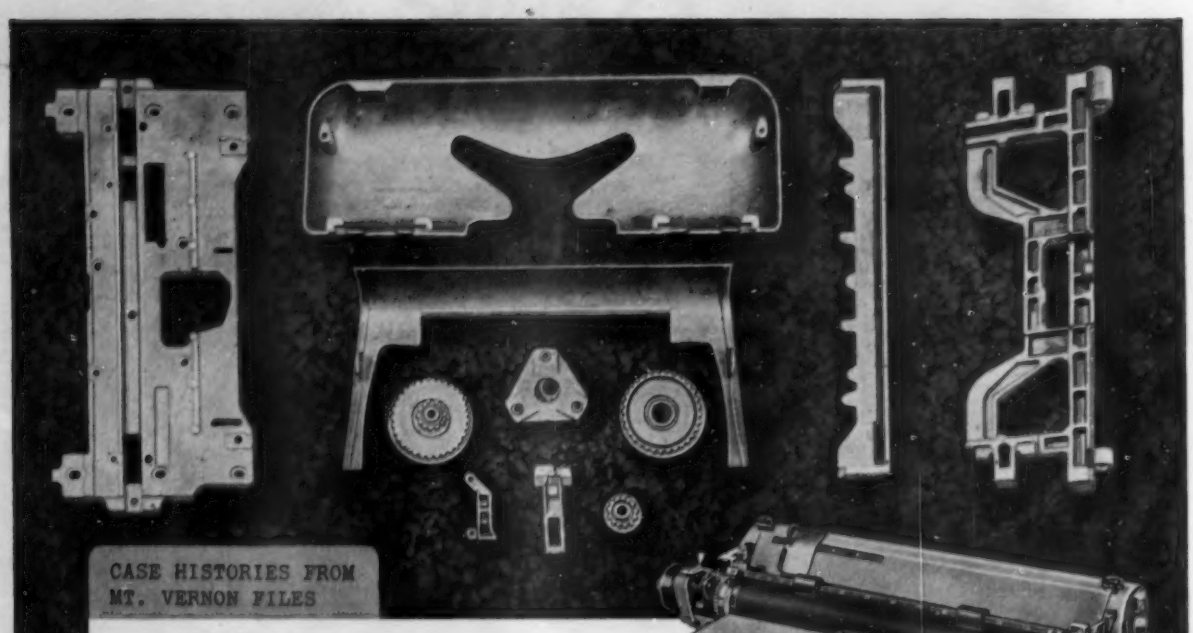


Photos: Dashler-Jarvis Div., National Lead Co. (top); Grier Reproducer Corp.

You're looking at a couple of die castings that won't add as much as a wiggle to the industry's production chart. But both are pretty important castings. The big aluminum reel (top) came out of the experimental die for a mammoth new machine. The miniature zinc pliers are an advertising novelty. This Mutt and Jeff combination is significant because it symbolizes die castings' major value: *versatility.* Versatility of size, shape, complexity. That's what die castings have to offer . . . along with the benefits of mass volume, low piece cost, fine surface. The way die castings have popped up in one new application after another during the last few years demonstrates this versatility. And work goes on, developing ways to make die castings better, faster. The list of advantages offered by die castings grows almost as fast as their applications.

Recording this dual growth, previewing forthcoming developments and interpreting them both to the men who apply, design, buy and process die castings is the job of PMM's annual Die Casting Forecast issue. If you're one of these men, be sure to

watch for September PMM



CASE HISTORIES FROM MT. VERNON FILES

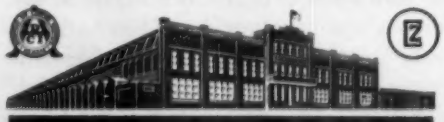
NOW!... 11 Die Cast Parts in Smith-Corona's New Electric!

Smith-Corona calls their newest Electric Typewriter "the fastest in the world." Other features they list as exclusive are "a cushioning action that eliminates all jar at the end of each keystroke"; "complete keyboard control, and a revolutionary new keyboard slope." Their aim is to make this machine the easiest to use of all electric typewriters.

Also interesting to note is Smith-Corona's increasing reliance on die casting. With the urgent need in the electric machine for intricate parts of great strength, rigidity, and high precision . . . the model shown here has no less than 11 die cast parts! These include top plate, keyboard guard, pulleys, pinion gear, and type bar segment mounting — all highly complex castings.

The more complex and manifold your production problems, the more natural — and profitable — it is to call upon Mt. Vernon. For as manufacturers in many fields have discovered, Mt. Vernon has the most complete die casting service — comprising coordinated designing, die-making, casting, and machining, all under one roof. We give you to the highest degree all the advantages of die casting: thin wall sections of great strength and rigidity, and parts produced to such close tolerances that often no machining is necessary. We have 162,000 square feet of the most modern equipment for making dies and for die casting aluminum and zinc.

It will pay you to bring your product specifications to us. We may show you, as we showed Smith-Corona, the way to important cost reductions and improved products.



MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

SALES REPRESENTATIVES

Mr. Grant Eller
6 East 194th St., Cleveland, Ohio

Mr. Jerome J. Theobold
9 East Genesee St., Skaneateles, N. Y.

Mr. Arthur Diamond, Tools Incorporated
86 Bethlehem Pike, Philadelphia, Pa.

Mr. Anker Anderson
Cascade Road, Stamford, Connecticut

Mr. William Sauers
101 Briarcliff Road, Rochester, N. Y.

Mr. David King
230 Grant Boulevard, Syracuse, N. Y.

Mr. George E. Hahl
39 South Munn Ave., East Orange, N. J.

For more information circle No. 46 on the Reader Service Card

PATENTS

continued from page 34

THE PRODUCTION OF IRON POWDER. An aqueous haloid salt solution containing iron ions is prepared. The iron is oxidized by blowing air through it so as to precipitate a sludge of iron hydrate. The sludge so formed is separated, washed and dried and then reduced to iron by a gaseous reducing agent. Reduction is carried out in stages, at least the last one of which is in hydrogen. The solution from which the sludge was removed is regenerated by dissolving iron in it again and the oxidation and sludge removal repeated.

Patent No. 2,735,757 — Heinz Georg Gerhard Zapf — assigned to Husqvarna Vapenfabriks Aktiebolag — issued February 21, 1956.

AN ALUMINUM LEAD METALLIC MIXTURE which is made by mixing aluminum and lead powders, compacting the mixture at about 250 C and then extruding at about 295 C. The lead content of the mixture can vary from about 5% to 50% by weight. The extrusion pressure is 20 tons per square inch and the extrusion ratio 30:1.

Patent No. 2,749,604 — Aubrey Latin — assigned to The Okonite Co. — issued June 12, 1956.

A PROCESS FOR MAKING POWDERED TITANIUM. An alloy composed of 40% to 60% titanium and from 35% to 60% aluminum is cooled violently from the liquid state. The resulting material is powdered and then treated with an alkaline solution which attacks the aluminum but does not attack the titanium for a sufficient length of time to dissolve substantially all of the aluminum in the alloy.

Patent No. 2,750, 271 — Jean Cueilleron and Charles Long — assigned to Societe d' Electro-Chimie d'Electro-Metallurgi et des Acieries Electriques d' Ugine — issued June 12, 1956.

THE FORMATION OF A SHELL MOLD ON A FROZEN MERCURY PATTERN. The shell mold is formed by applying to the surface of a frozen mercury pattern a slurry consisting of a refractory material of fine particle size, a resinous binder and a solvent for the resinous binder. The binder is of a type that will bind the refractory material together and to the frozen mercury and is effective as a binder from a temperature below the melting point of mercury up to about 600 C. The solvent for the organic binder is liquid at temperatures below the melting point of the mercury and vaporizes below zero centigrade. The resinous binder is used in amounts ranging from 0.25% to 7% by weight of the refractory and

Continued on page 75

It's worth repeating.. ..for the safety of.. .your men, property. ..and machines.. ..change over to.. UCON Brand Hydrolubes.. CARBIDE'S safety hydraulic fluids..

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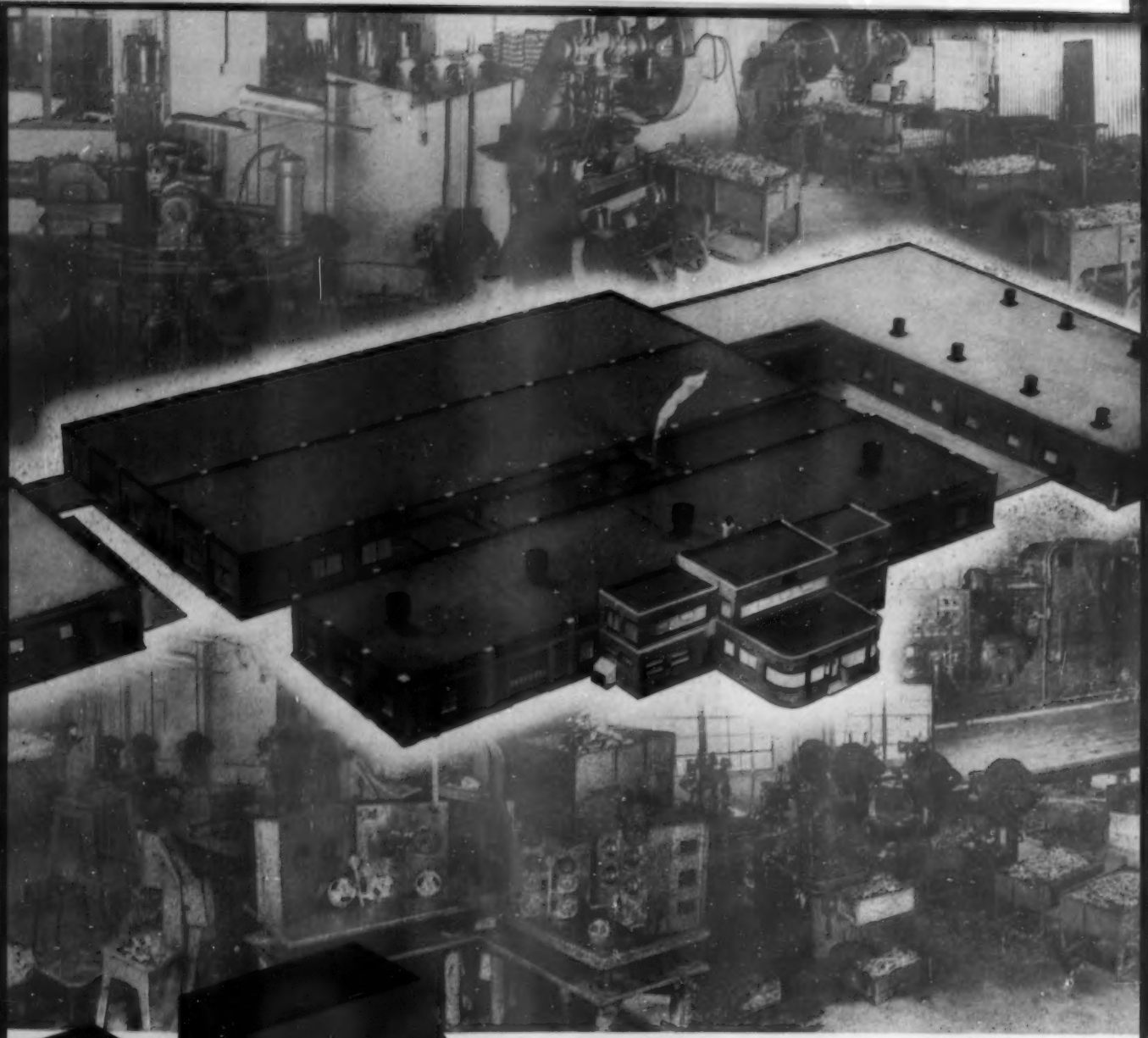

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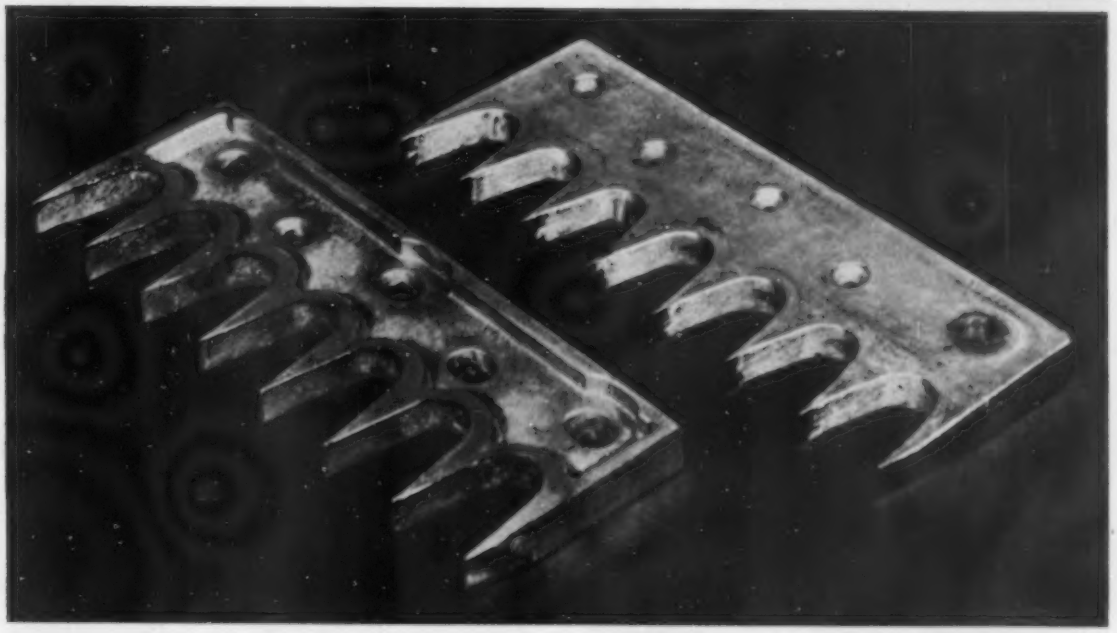


OLD ICE REMOVAL BLADE of steel (right) required expensive flame cutting machining for correct rake and tolerance of teeth. New part (left) is cast of manganese bronze by shell molding. Finishing operations are simple and inexpensive.

SCRAPING BLADE was previously produced by welding four parts of bar steel and machining the cutting lip to a 30° angle and required cleaning of weld slag and excess flash from arc welding. The new shell molded manganese bronze blade shown at right reduced costs and improved corrosion resistance.

How Replacement Of Flame Cut And Welded Pieces Saved 50 Percent

FORMERLY flame cut and machined from bar steel and then drilled, ice removing blades of Carrier's Flakemaster automatic flake-ice making machines, are now cast by shell molding methods by Bennett-Ireland, Inc.

In addition to the ice removing blades, scraping blades which had previously been welded of four different parts are integrally cast also by shell molding.

According to Carrier development engineers, production of the original steel parts by cutting, machining, drilling and welding created a very costly and lengthy manufacturing process. Now, shell molding of these parts makes possible cost reduction of 50 percent. In addition, the new blades of manganese bronze have better corrosion resistant qualities than the steel parts.

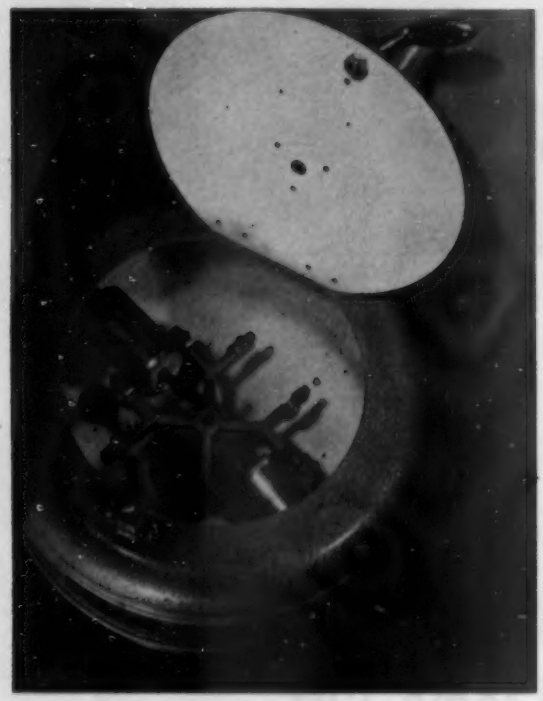
Both blades are part of an assembly which flakes the ice from the cylinder wall of Carrier's Flakemaster machines.

Bennett-Ireland makes shell cores for the new ice removal blade on a standard Shalco dump shell core machine using a split aluminum core box fitted with ejector pins. The core produces the correct angular rake to the teeth

Continued on page 66

New shapes and properties can be obtained from metal powders, according to results of this experiment in . . .

Slip Casting



1. **EQUIPMENT NEEDED** for producing the mold is simple. Shown here are the wooden shell halves with the brass insert, along with the mold halves in gypsum plaster.

2. **FOR CASTING,** this setup was used. Plaster mold and pouring spout are in position for casting in this centrifuge.

3. **FROM MOLD TO FINISHED PIECE** is illustrated here. At left is the mold containing as-cast slip. Sintered and unsintered samples are compared.

SUSPENSIONS of solids in a liquid media have been used since the first pottery pieces were produced early in our civilization. The ceramics industry today still uses these basic materials in the production of various components. The oldest method of working clay and water suspensions consisted of forming plastic clay by hand to form a brick or other simple shape; the potters wheel was used to form hollow shapes, such as vases.

More recent developments utilize a plastic clay, thicker than that which can be worked by hand, and which instead is forced through a die to form a continuous block or tube. These pieces are cut to desired length and fired at elevated temperatures to drive off the water and to consolidate or densify the product.

Clay and water mixture of a thin consistency, which cannot be formed in the manner described above, can be fabricated into various types of hollow or solid pieces by a casting process. This method consists essentially of casting the water and clay mixture, which is known as a slip, into a plaster mold, permitting the slip to dry or set as the water is absorbed by the porous mold, then followed by high-temperature firing to impart the final physical and mechanical properties of the material.

In powder metallurgy as well as in ceramic processes, solid components can be produced from pulverized materials which are usually compacted with no liquid present, although in some instances, a solid type of binder or lubricant may be used. After pressing, samples are then sintered at elevated temperatures to densify the part and to improve its properties.

Of Stainless Steel Powder - Part 1

BY W. G. LIDMAN AND R. V. RUBINO
Atomic Energy Division
Sylvania Electric Products, Inc.

The use of steel dies for compacting make it difficult to produce pieces which are hollow or have projections or other characteristics which would make it difficult to eject from the die. A method of slip casting for fabricating intricately shaped objects from refractory powders is described in reference 1. Slips with a high solid content were used in the investigation of reference 1, and the feasibility of the process was demonstrated.

The purpose of this present report is to present the results of an investigation to determine the feasibility of applying slip casting techniques, using low metal content slips to powder metallurgy materials. Solid samples were prepared from stainless steel powders, in order to permit comparison of properties of this product with that produced by compacting and sintering.

Apparatus and Procedure

Molds. The prime requisite of the mold in this application, as in any casting process, is to provide the desired contour to the cast material while in the plastic state and maintain support until the cast material has sufficient strength to retain the induced shape.

Slip casting of metal powders differs from conventional casting in that the prepared slip contains a considerable amount of moisture which must be removed before stripping. Removal of this moisture can be accomplished by evaporation or by mold absorption.

Also, the slip is prepared and cast at room temperature. Consequently, the requirements for a satisfactory mold material were: sufficient mold strength for providing support and shape, ability to absorb moisture, ease of preparation, ease to release compact after drying, and inexpensiveness.

Plaster of Paris appeared the most logical material for this application. Investigations were conducted on the preparation of plaster molds, with considerable attention devoted to the effects of such variables as water content, mixing time, and mixing speed on mold appearance.

The schedule which appears below produced a mold of extremely sharp edges, and also one that was void of air bubbles on the surface of the cavity.

Mold Schedule

%	Constituent
55	Red Top White Gauging Plaster
45	Tap Water (25 C)

Mixing time 3 minutes—Mixing speed 450 rpm

Other gypsums, such as Fisher Scientific Company's calcium sulphate, U. S. Gypsum Company's Hydrocal B-1 were also evaluated. The molds produced from these materials had properties similar to those of the white gauging plaster.

Additives of 0.5% silicon dioxide and 0.5% graphite were also tried in an attempt to enhance the plaster mold release qualities. No particular improvement occurred as a result of these additions. Additives in quantities greater than this tended to provide particles which served as nuclei for air bubbles which were undesirable.

The actual mold preparation technique consisted of coating the wooden shell and metal insert shown in Figure 1 with a soap solution which was then allowed to air-dry. A coating of this type was found to be extremely effective with respect to mold release. The metal insert was then placed between the shells and the prepared plaster was poured. Thirty minutes after pouring, the plaster mold was removed. The finished mold was allowed to air-dry at room temperature for 48 hours. Heat applications, of course, would reduce the mold drying time considerably.

To further improve the release characteristics of the plaster mold itself, a coating of soap solution was applied. Clear lacquer was also tried and found to be equally as good as the soap solution with respect to release and somewhat more substantial with respect to endurance.

Slip bonding. The essential components of the slip investigated in this study were stainless steel powder (302-B), ammonium alginate for bonding the powder particles, Du Pont's Elvanol Grade 72-60 (polyvinyl alcohol) for elasticity, and water for fluidity.

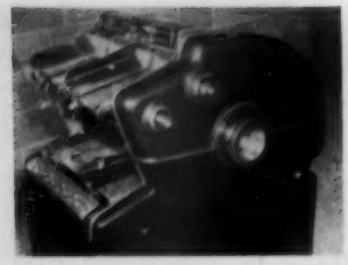
After considerable investigation as to the proportions of each of the constituents, mixing speed, and mixing time, a schedule was evolved which rendered a slip which was fluid enough to pour easily and yet firm enough to retain its shape after stripping from the mold. The composition and mixing conditions arrived at are as follows:

74.55%	Stainless steel powder
24.85%	Tap water (room temp.)
0.35%	Ammonium alginate
0.25%	Elvanol

Mixing speed 1100 rpm
Mixing time 2 hours

In order to improve slip properties of fluidity and stripped-slip strength a "hot-slip" was also

Continued on page 83



To bring the printing quality of the offset press into the average business office . . .

They Use 70 Castings In 4 Alloys In This Modern Duplicator

IN order to bring print-shop clarity to office duplicating, offset duplicating is the best system that can be employed, but an offset printing unit is a more complicated piece of equipment than the conventional office duplicating equipment. As usual, increased complexity carries with it increased manufacturing costs and the components are likely to have increased functional requirements.

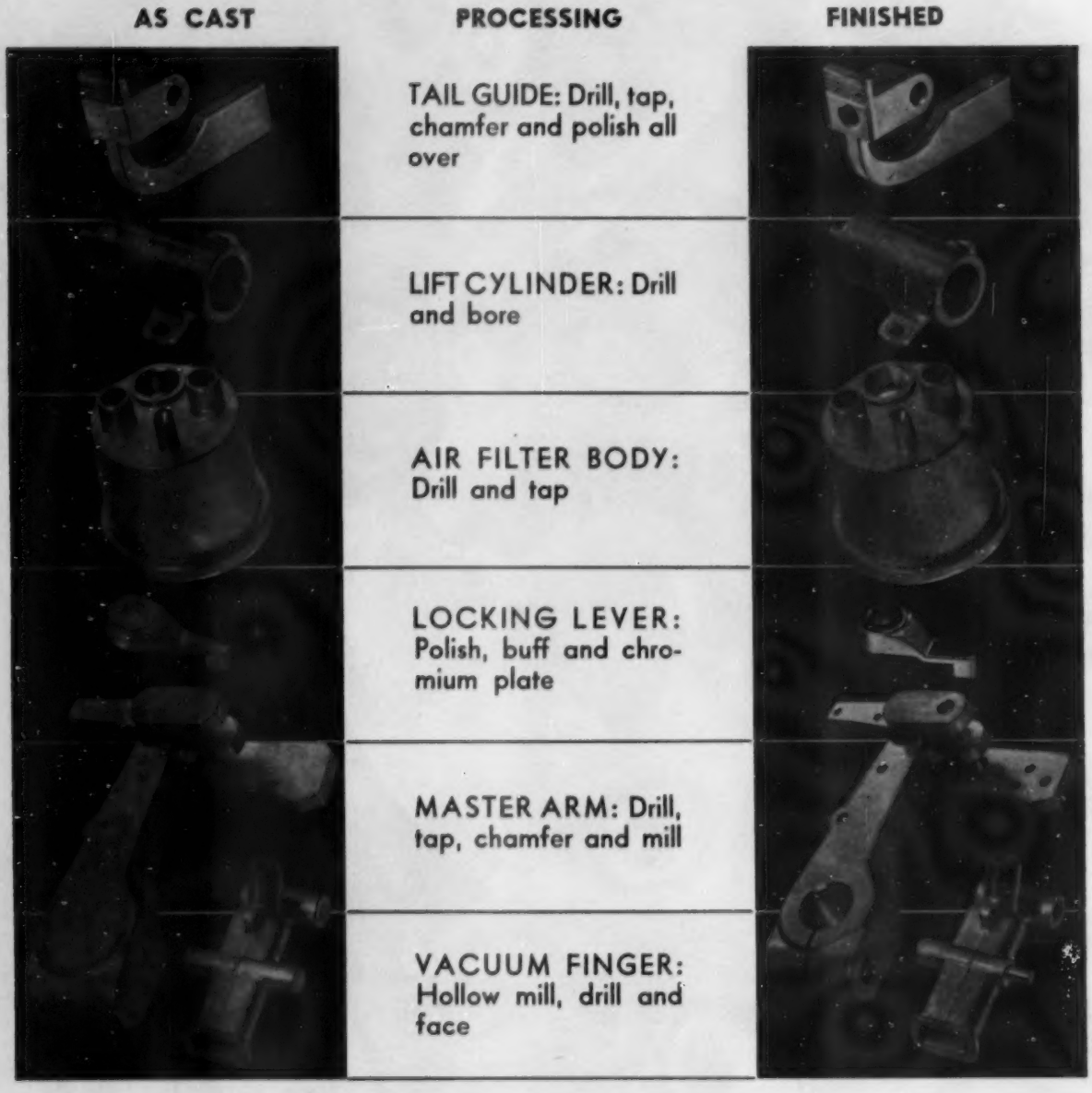
The stereotyped approach to a new machine might have been to rely heavily upon such processes as sand casting and stamping for the majority of components. The temptation to avoid substantial investment in tooling for die casting or permanent mold casting might obscure the superiority of design, surface and structure that can be obtained by these processes.

At Ditto, Inc., the design and production engineering departments are familiar with the advantages of die casting and permanent mold casting, and designed specifically to make use of these processes. As a result, this brand new duplicating offset printer incorporates more than 70 different die and permanent mold castings in it.

Company designers have also made use of almost the full palette of available metals, using zinc, aluminum, brass and aluminum bronze alloys. Some of these are die cast, some cast in permanent molds, and several are vacuum die cast.

Liberal use has been made of cast-in inserts for those places where threads in softer metals might not have the required holding capacity. In such places, threaded steel inserts have been used.

KNOB
ZINC
DIE CAST
EJECTOR
ALUMINUM
DIE CAST
ARM
ALUMINUM BRONZE
VACUUM
DIE CAST
KNOB ALUMINUM
DIE CAST
MOISTENER
TRAY
ALUMINUM
DIE CAST
AIR FILTER
BODY
ALUMINUM
DIE CAST
LOWER HANGER
ALUMINUM BRONZE
VACUUM DIE CAST
VACUUM FINGER
ALUMINUM
DIE CAST
LEVER ZINC
DIE CAST
VALVE BODY
ALUMINUM
DIE CAST


AS CAST
PROCESSING
FINISHED
TAIL GUIDE: Drill, tap, chamfer and polish all over
LIFT CYLINDER: Drill and bore
AIR FILTER BODY: Drill and tap
LOCKING LEVER: Polish, buff and chromium plate
MASTER ARM: Drill, tap, chamfer and mill
VACUUM FINGER: Hollow mill, drill and face

HOW DITTO USES PMM CASTINGS — continued

Because Ditto's engineers are thoroughly conversant with the possibilities and limitations of these PMM processes, and they have consulted their vendors for advice on engineering details, they have been able to reduce machining operations to a minimum. Most die cast and permanent mold cast components are received by Ditto close to finished condition.

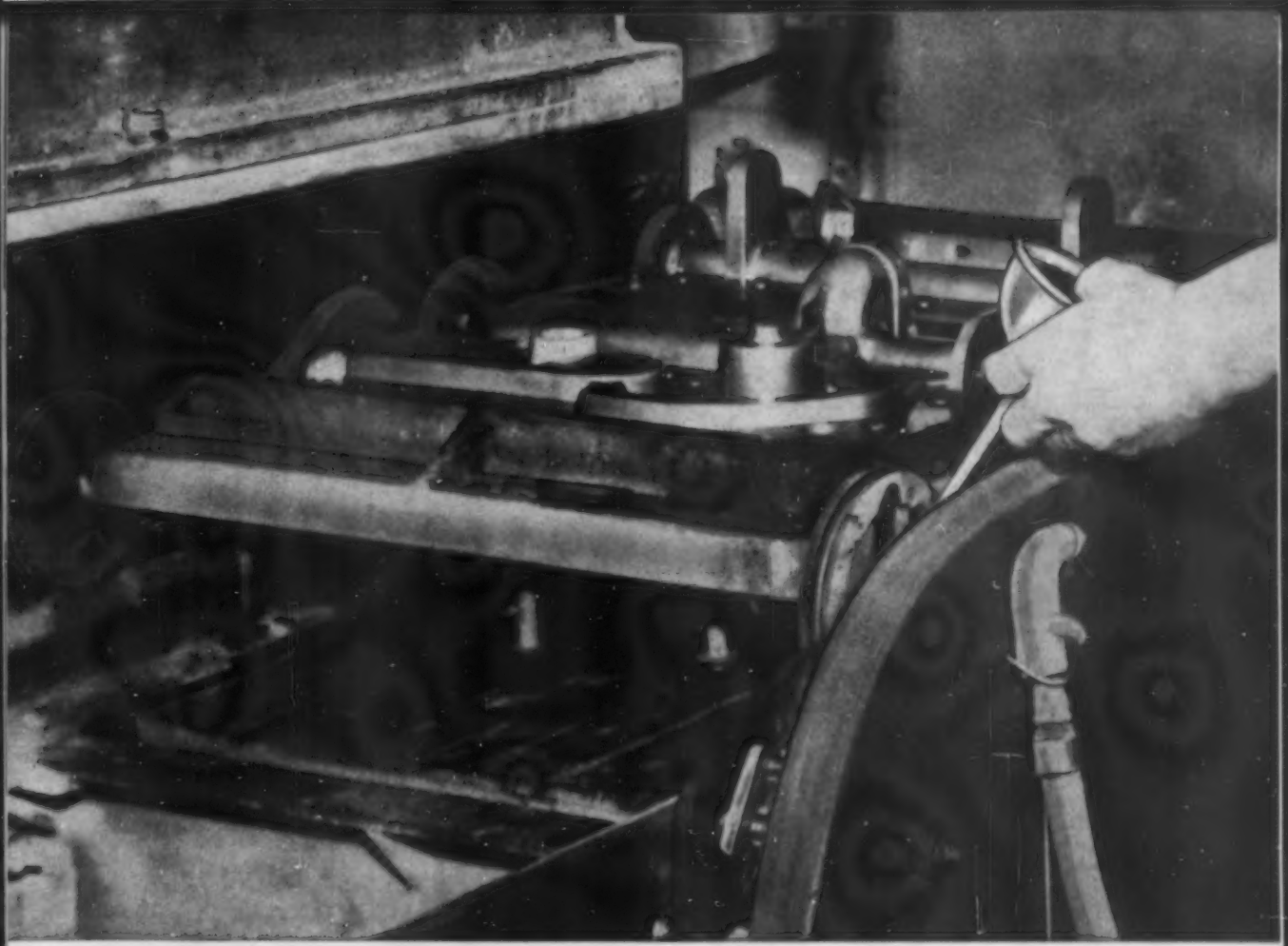
Before-and-after views of six typical castings reveal that no heavy machining operations are required. Most common are light drilling, tapping, chamfering and facing operations.

A variety of finishes are applied, depending upon the function and appearance requirements. Included in operations performed by Ditto are polishing, buffing, painting and plating.

By its use of an effective range of properties and characteristics available from die and permanent mold castings, Ditto has been able to produce an offset duplicator that competes with heavy presses in work quality, but compares favorably with conventional office duplicators in price.

Companies producing the die and permanent mold castings for Ditto, Inc., include: Acme Aluminum Foundry Co., Aurora Metal Co., Chicago White Metal Products, Inc., Pressco Casting & Mfg. Co., and Product Engineering & Mfg. Co.

For more information circle No. 3 on the Reader Service Card



'dag' dispersions . . . *a touch does so much!*

'Oildag' vital to continuous molding-machine operation

Production Pattern & Foundry Company of Chicopee, Mass. runs its five shell-molding machines 24 hours a day to keep up with casting-floor demand for molds. To stand up under this tough service, the machines must be properly maintained.

Maintenance personnel at Production Pattern & Foundry have found that lubrication instructions of the machine's manufacturer have paid off handsomely. Shell Process Co., which makes these shell-molding machines, recommends **'Oildag'** — colloidal graphite in petroleum oil — diluted with five parts of No. 10 oil for the lubrication of critical wear points: the axle bearings of the drive mechanism, and hitch-pivots and link pins of the roller chain. Since the roller chain is subjected to 900° F temperatures within the shell-baking oven, conventional lubricants would be useless . . . would decompose and carbonize. Proof of the effectiveness of colloidal graphite for this heavy-duty high-temperature lubrication job is the fact that the machines have operated without breakdown for more than six years!

Dispersions of colloidal graphite are extremely valuable elsewhere in the foundry too: as long-lasting lubricants for moving parts of casting machines and other foundry mechanisms; as heat-resistant ladle coatings, and effective mold coatings for better parting and controlled cooling. You can learn more about the use of **'dag'** dispersions in metal-casting operations through Acheson's Bulletin 425. Write for your free copy today.

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While developing methods of casting extremely intricate radar waveguides, this company found a way to cast . . .

Shapes Unlimited

Now they are investigating uses for this technique in other fields.

WHILE seeking an improved way to make the tortuous shapes of radar "plumbing," a manufacturer of microwave transmission equipment has developed a method of producing extremely complex components with a high degree of accuracy. This process, which combines many features of investment casting with those of other precision foundry techniques, has already found many practical uses.

Budd-Stanley Co., Inc., designers and manufacturers of microwave transmission equipment, were seeking a way better than hand assembly for producing radar waveguide elements. These components are characterized by complexity of shape, high finish on interior surfaces and internal configurations that defy normal machine-shop or foundry fabrication.

Airborne waveguides must be made of aluminum or magnesium, which poses another problem . . . how to braze or weld the light gauge sheet metal without serious distortion. The presence of brazing metal along inside is often objectionable.

The solution developed by Budd-Stanley is a precision casting method using expendable patterns and monolithic molds, but also introducing features of plaster mold casting and other processes. The trick, company engineers say, is the selection of the proper combination of techniques to meet the specific requirements of any piece. So far, they report, no shape of electronic "plumbing" has been found that cannot be produced by this process, although the economic considerations must be analyzed in each instance.

The five phases of the problem undertaken were: 1) Develop a method of making intricate patterns of a dimensionally stable material, 2) Get the mold material into all configurations while meeting all other requirements of a good mold material, 3) Get the pattern material out of the mold without leaving harmful residues, 4) Get the molten metal into all the configurations without producing disqualifying defects, and 5) Get the mold material out of the complex contours and interiors.

The process that has resulted from this investigation is now being used on a production basis. Here is a report of some of its special features, along with design limitations imposed by the process.

Materials. The process is limited to the non-ferrous range, and is especially useful for aluminum, magnesium, beryllium copper and the brasses. Other non-ferrous alloys may be practical, but experience so far has been restricted largely to the alloys listed.

Size. The only apparent limit to size, the company claims, is the capacity of existing facilities. Largest casting produced to date is about 24 inches in its longest dimension.

Complexity. Here is the main feature of the process, for it is being used to cast waveguides of great complexity. Interior bosses, baffles and projections that are entirely enclosed in winding passageways are not unusual; internal or external threads are cast with class 2 fit; blind slots a few thousandths of an inch wide are cast inside of waveguide sections; inside surfaces cast to 60 microinches and unorthodox combinations of thick and thin sections appear in various components now being produced.

Thickness. One range of microwave components has walls that average about .050 in thickness, while another tubular section measuring about 1½ inches in length has a .015 - .018 wall.

Finish. Best surface yet cast on a selected area is described as being about 30 microinches, with standard surface inside some radar components held close to 60 microinches.

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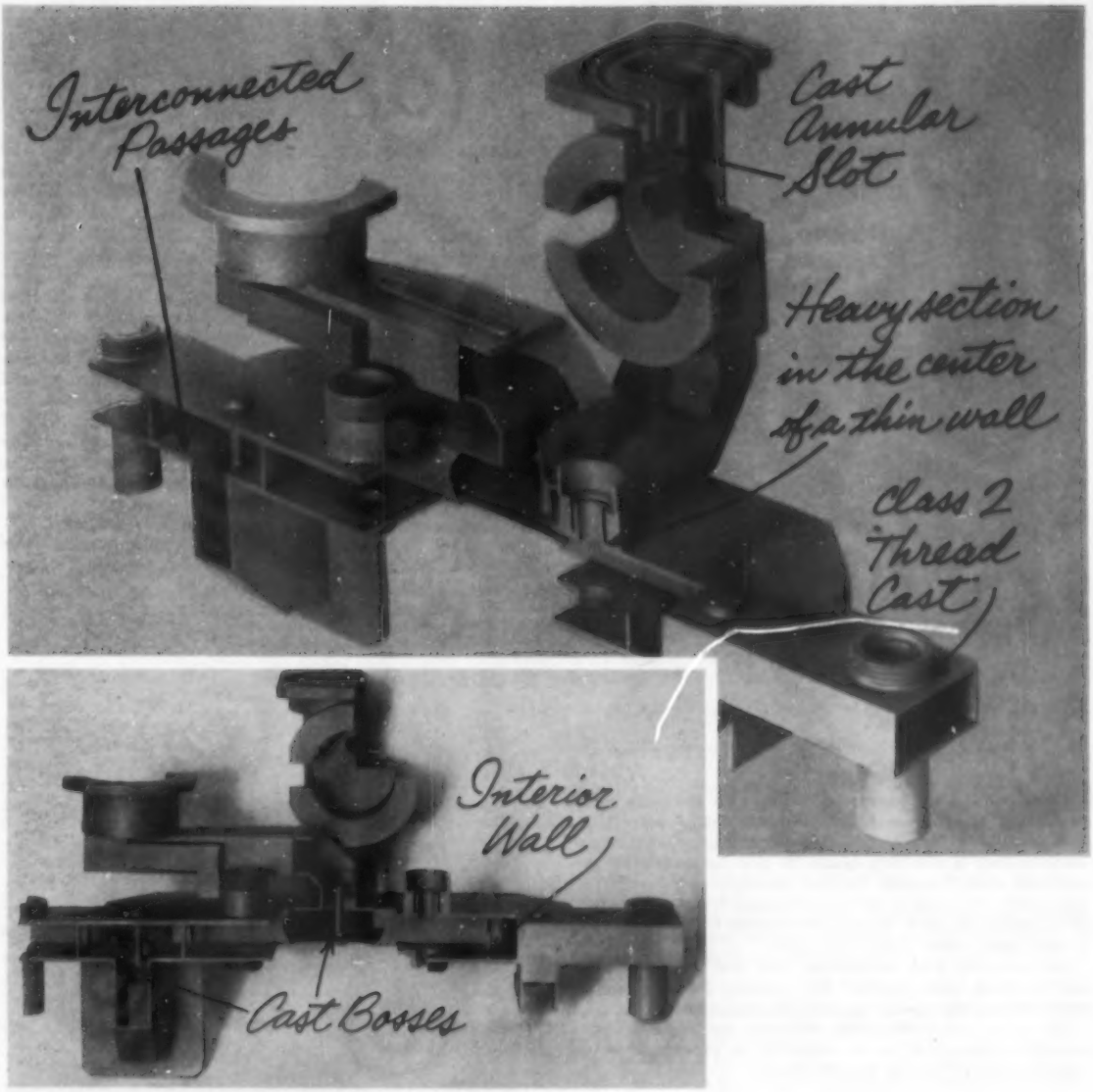


HERE ARE SOME CASTINGS THAT ILLUSTRATE WHAT CAN BE DONE

MICROWAVE TRANSMISSION COMPONENTS are required to carry radar signals between the receiving and amplifying equipment without attenuation of the signal. Surface roughness that creates turbulence has the effect of diminishing or destroying the minute signals. Since the signals must be conveyed without loss of strength through carefully planned channels, often of complex shape, internal surface finish is one of the most critical requirements.

Yet, due to the complexity of the shapes, with the multiplicity of geometric planes, visual inspection is impossible without destroying the components. Consequently, all inspection must be performed electronically.

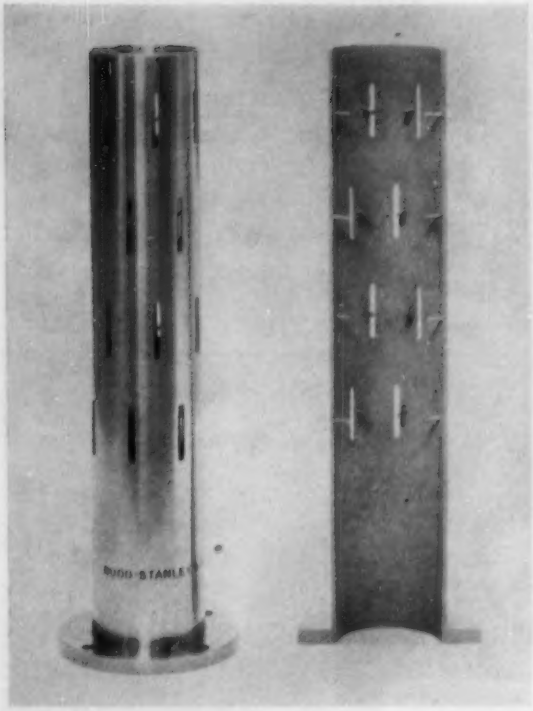
The X-Band Mixer, shown above with several cutaway sections, is one such intricate radar waveguide component. This unit, cast with walls approximately .050 thick, was formerly constructed from sheet, tube and rod stock brazed together. To braze this unit was difficult because temperature of brazing was not far from the melting point of the sheet metal itself. Repeated heating and cooling created warpage and distortion resulting in unacceptable variations in shape.

Several brazing fixtures were required and a number of separate forming and assembling operations were involved. Inspection, too, at each stage of assembly, was an important part of manufacturing costs.

All flanges on components such as this X-Band Mixer are related to the same reference lines or dimensions. That is to say, they must all be perfectly parallel or perpendicular to the same plane, which was costly to achieve from assembled fabricated units.

In the cutaway views, above, can be seen such special features cast integrally as: small, round bosses cast inside the waveguide and accurately located with regard to surrounding walls; heavy-sectioned areas located in the center of thin walls; interior partitions having about the same wall thickness as the rest of the structure; small,

More Shapes . . .



OMNI-DIRECTIONAL RADAR ANTENNA, left, is another example of a difficult and expensive fabricated unit that has been produced at lower cost by the Budd-Stanley casting process. Improved accuracy has also been achieved.

This unit, which is 7 inches high and 1¼ inches in diameter, was machined from tubular stock. The vertical slots were milled or engraved. The projecting pins inside the tube, which can be seen in the cutaway view, were cut off and inserted into drilled holes, then brazed or soldered. The extremely high requirements on accuracy make this difficult to fabricate, even using expensive jigs and fixtures.

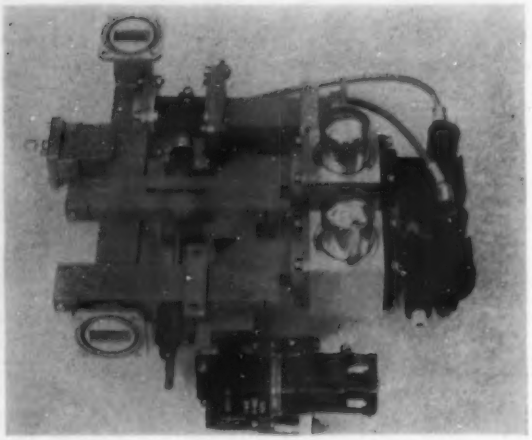
Not only must the slots be uniformly distributed around the circumference, but must each be accurately sized. The interior pins must all be normal to the cylinder so that, if projected, they would meet precisely in the center. Cumulative tolerances are not allowed in the position of the slots or the bosses relative to the base, and tolerances on length and diameter of bosses are critical.

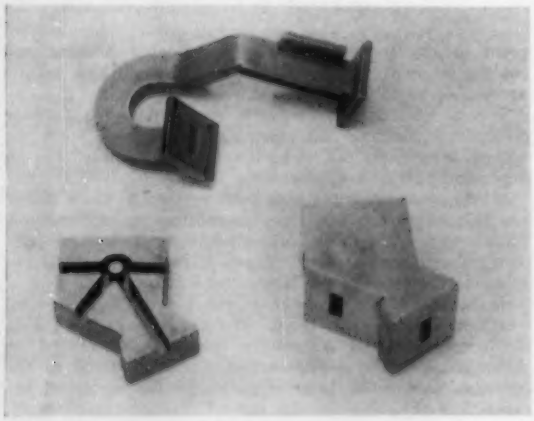
As can be visualized, this is an extremely difficult fabrication job. It is now being produced at considerably lower cost and higher accuracy by this new casting technique. Only the OD needs to be turned.

MAGNESIUM is the preferred material for the main component of this Duplexer, shown completely assembled. Because of the impossibility of joining thin magnesium sections into a complex shape, it and its associated assemblies were formerly the only member of the airborne radar unit that could not be produced from magnesium. Now, using the new casting technique, it has been cast in one piece from magnesium alloy.

As produced from aluminum tube and rod, this large and complex unit required 182 separate forming operations, 24 brazing operations and 46 inspections.

The same requirements on accuracy, surface finish and structural soundness as are called for in other microwave components, pertain to this Duplexer.





VARIETY OF SHAPES likely to be specified in waveguides is illustrated by three small components, including the K-Band Duplexer, left, which is sometimes called a "Rat Race". These pieces, while smaller and far less complicated than the Mixer, Duplexer and Antenna shown above, present some production problems. The heavy section of the "Rat Race" illustrates the soundness of casting which is possible. The waveguide at the top, with its U-curve and oblique angle, present difficult coring problems in any conventional casting method.

Aluminum Base Alloy Die Castings

The American Die Casting Institute has just issued the first several of its Metallurgical Series of Product Standards for Die Castings, providing useful data as a guide to engineers and designers. Three of these standards covering the composition, properties and characteristics of Standard and Special aluminum base die casting alloys are presented here. Complete copies of all Standards are available by writing to American Die Casting Institute, Inc., 366 Madison Ave., New York 17, N. Y.

1. ALLOY SELECTION

The aluminum alloys most commonly used are shown below as Standard Alloys. Die casting and other processing characteristics data involved in alloy selection are covered in Section 3.

The *Standard Alloys* provide commercially satisfactory combinations of properties and characteristics at the lowest cost. The *Special Alloys* should be selected only when the nature of the requirements justifies the higher metal and processing costs involved. For example:

- Alloy 360, SG100B, provides somewhat better ductility and corrosion resistance than either of the Standard Alloys;
- Alloy 39-11, SC114A, has excellent fluidity or die-filling capacity which is of advantage in producing large, thin walled, intricate die castings;
- Alloy 218, G8A, provides the best combination of strength, ductility, corrosion resistance and finishing qualities but is more difficult to die cast;
- Alloy 43, S5C, is sufficiently ductile for special applications requiring forming or upsetting during assembly operations but is difficult to die cast.

2. COMPOSITION AND PROPERTIES

The chemical compositions of aluminum base alloy die castings and related typical values for physical properties and constants are shown in the table. The typical values indicated are for separately cast test bars and do not represent values for specimens cut from die castings.

	STANDARD ALLOYS*		SPECIAL ALLOYS			
Commercial ASTM	13 S12B	380 SC84B	360** SG100B**	39-11 SC114A	218 G8A	43 S5C
Composition-percent (1)						
Copper	0.6	3.0-4.0	0.6	3.0-4.5	0.25	0.6
Iron	2.0	2.0	2.0	1.3	1.8	2.0
Silicon	11.0-13.0	7.5-9.5	9.0-10.0	10.5-12.0	0.35	4.5-6.0
Manganese	0.35	0.50	0.35	0.50	0.35	0.35
Magnesium	0.10	0.10	0.40-0.6	0.10	7.5-9.5	0.10
Zinc	0.50	1.0	0.50	1.0	0.15	0.50
Nickel	0.50	0.50	0.50	0.50	0.15	0.50
Tin	0.15	0.35	0.15	0.35	0.15	0.15
Total Others	0.25	0.50	0.25	0.50	0.25	0.25
Aluminum	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder
Properties and Constants (2)						
Tensile Strength psi	36,000	43,000	43,000	43,000	41,000	30,000
Yield Strength (0.2% offset) psi	21,000	25,000	25,000	27,000	27,000	16,000
Elongation, % in 2 in.	2.0	2.0	3.0	2.0	7.5	5.0
Shear Strength, psi	25,000	28,000	27,000	28,000	28,000	19,000
Fatigue Strength, psi (3)	19,000	20,000	19,000	19,000	23,000	17,000
Specific Gravity	2.65	2.71	2.63	2.70	2.57	2.65
Weight per cu. in., lbs.	0.096	0.098	0.095	0.098	0.093	0.096
Melting Point (Liquid), °F.	1080	1100	1105	1080	1150	1170
Thermal Conductivity, CGS	0.29	0.23	0.27	0.23	0.23	0.34
Thermal Expansion, in/in/°F (4)	11.9	12.1	12.2	11.7	13.9	12.9
Electrical Conductivity, % of Copper Standard	31	23	29	23	24	37

(1) Composition in per cent, maximum unless shown as range. Same as ASTM B85.
(2) Data furnished by Aluminum Company of America and ASTM B85. Revisions are in progress and will be made from time to time.
(3) R.R. Moore rotating beam test data at 500,000,000 cycles.
(4) To be multiplied by 10^{-6}. Temperature range 68° to 392°F.
*These Standard Alloys are also available with 1.3% maximum iron content (designated 13X and A380) having 3% elongation.
**This alloy is also available in lower iron composition, A360.

3. CHARACTERISTICS OF ALUMINUM ALLOYS

Selection of an aluminum base alloy die casting requires evaluation not only of physical properties, constants, and chemical composition of the die casting, but also of the alloy itself and its effect on production of the die casting and in finishing. The table includes certain casting and other outstanding characteristics which are usually considered in selecting a die casting alloy for a specific application. The characteristics are rated from (1) to (5), (1) being the best and (5) being the least desirable alloy. In applying these ratings, it should be noted that all the alloys have sufficiently good characteristics to be accepted by users and producers of die castings. Hence a ratings of (5) indicates a commercial alloy, although in certain cases its application may be limited or its manufacture may be restricted to relatively simple die castings.

	Die Casting Characteristics						Other Characteristics (k)					
Alloy	Approximate Melting Range °F.	Resistance to Hot Cracking (a)	Pressure Tightness	Die-Filling Capacity (b)	Anti-Soldering to the Die (c)	Resistance to Corrosion (d)	Machining (e)	Polishing (f)	Electroplating (g)	Anodizing (h) (Appearance)	Chemical Oxide Coating (i) (Protection)	Strength at Elevated Temp. (j)
Standard 13, S12B 13X, S12A	1065 — 1080	1	1	1	1/3	3	4	5	3	5	3	3
380, SC84B A380, SC84A	1000 — 1100	2	2	2	1/2	4	3	3	1	3	5	2
Special 360, SG100B A360, SG100A	1035 — 1105	1	1	1	2/3	2	3	3	1	3	3	2/1
39-11, SC114A	960 — 1080	2	2	1	3	4	3	3	2	4	4	2
218, G8A	995 — 1150	5	5	4	5	1	1	1	5	1	1	4
43, S5C	1065 — 1170	2	3	3	4	3	5	4	2	2	3	5

(a) Ability of alloy to withstand stresses from contraction while cooling through hot - short or brittle temperature range.

(b) Ability of molten alloy to flow readily in die and fill thin sections.

(c) Ability of molten alloy to flow without sticking to the die surfaces. Ratings are given for both iron compositions for 13, 13X; 380, A380; and 360, A360.

(d) Based on resistance of alloy in standard type salt spray test.

(e) Composite rating based on ease of cutting, chip characteristics, quality of finish, and tool life.

(f) Composite rating based on ease and speed of polishing and quality of finish provided by typical polishing procedure.

(g) Ability of the die casting to take and hold an electroplate applied by present standard methods.

(h) Rated on lightness of color, brightness, and uniformity of clear anodized coating applied in sulphuric acid electrolyte.

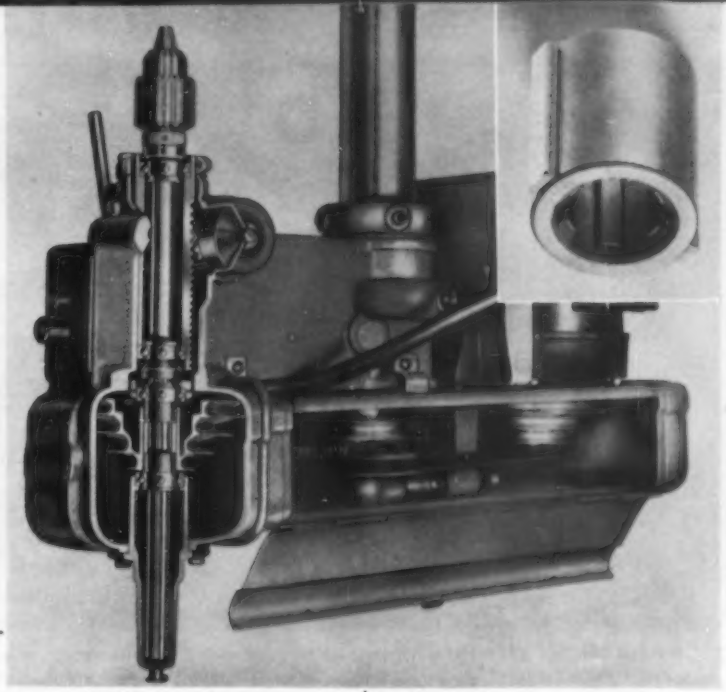
(i) Rated on combined resistance of coating and base alloy to corrosion.

(j) Rating based on tensile and yield strengths at temperatures up to 500°F., after prolonged heating at testing temperature.

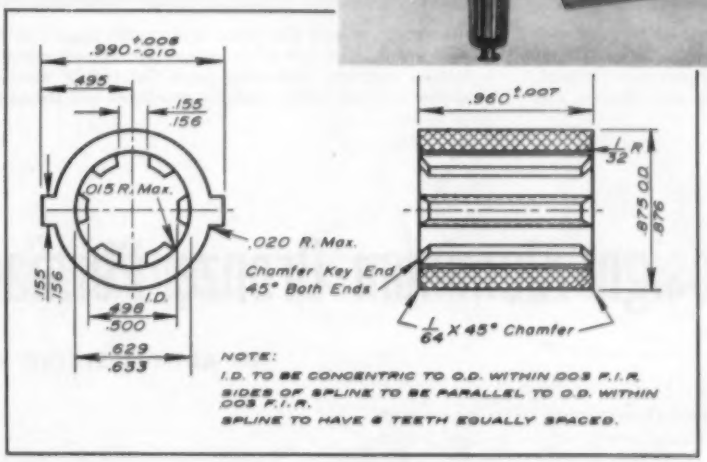
(k) Die castings are not usually solution heat treated. Low temperature aging treatments may be used for stress relief or degrowthing. Die castings are not generally gas or arc welded or brazed.

4. ALLOY CROSS REFERENCE CHART

COMMERCIAL DESIGNATION / NOMINAL COMPOSITION			13 Si 12%	380 Cu 3.5% Si 9.0%	360 Mg 0.5% Si 9.5%	218 Mg 8%	39-11 Cu 3.8% Si 11%	43 Si 5%
Symbol	Specifying Organization	General Spec. No.	DESIGNATIONS USED IN SPECIFICATIONS:					
ASTM	Amer. Soc. for Testing Matls.	B-85	S12A S12B	SC84A SC84B	SG100A SG100B	G8A	SC114A	S5C
SAE	Society of Automotive Engineers		305	306 308	309		303	304
FED	Federal Specifications	QQA-591a-1	Comp No. 1 Comp No. 2	Comp No. 10 Comp No. 11	Comp No. 12 Comp No. 12A	Comp No. 7		Comp No. 3
MIL	Military Specifications	MIL-A-15153a	Class 1	Class 10	Class 9	Class 7		Class 3
AMS	Aeronautical Materiel Spec.		4292	4291A-2	4290E			
AF	Air Force	MIL-A-8294	Comp No. 1		Comp No. 2			



ADEQUATE SHEAR STRENGTH to transmit full driving torque plus self lubrication are required of this splined bushing. Made from sintered steel it performs satisfactorily.



BY JOHN D. HOWELL,
Chief Engineer
Kearney & Trecker Corp.,
Walker-Turner Div.

Sintered Steel — for high shear strength service

To transmit power from the pulley to the chuck and, at the same time, permit vertical movement, most drill presses utilize a splined drive shaft rigidly fixed to the chuck and a mating female member, generally called a spline insert that is permanently fixed to the drive pulley of the press. In this manner, rotary motion is positively transmitted through the splines while allowing free vertical movement of the quill.

Since the splined shaft is relatively long and must transmit the entire torque of the motor, up to and including stalling torque, it is always made of a good grade of hardenable steel that has a high yield point in torsion.

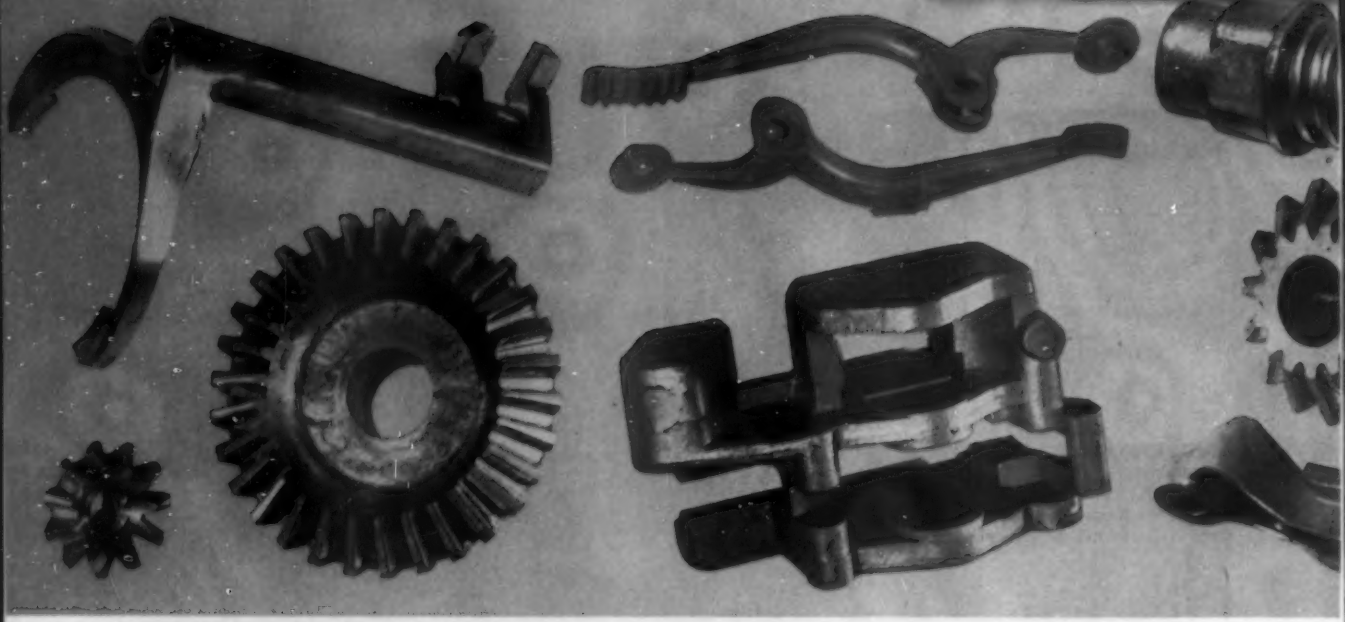
The spline insert which must also transmit the full torque is, however, relatively short so that failure in torsion is unlikely, but failure in shear is a distinct possibility. Wear resistance is also a problem on the spline insert as is an adequate method of anchoring it in the pulley.

Early design of the spline insert called for a piece broached from heavy wall steel tubing. Such a part had many disadvantages such as lack of dimensional reproducibility due to wear of the broach, difficulty of adequate lubricating resulting in high rates of wear and difficulty in securely anchoring the insert in the drive pulley which is often a zinc or aluminum die casting.

About 2½ years ago, the insert on Walker-Turner drill presses was redesigned to be made from iron powder. With this method of manufacture of the insert, it became possible to make some desirable design changes and secure a better part at lower cost.

Because of the high shear strength required, the insert had to be made of a high strength material, but to secure the desired lubricating properties it had to be porous. The material finally selected for the job is Super-Oilite made by the Amplex Div. of the Chrysler Corp. finished to meet the dimensions and tolerances shown in the drawing. While the tolerances called out in the

Continued on page 56



1. **WHERE TENSILE STRENGTH** needs to be coupled with other special properties such as corrosion resistance, aluminum bronze permanent mold castings can be used. Although this alloy is difficult to cast in some shapes, this illustration reveals the range of sizes and shapes now successfully cast in this alloy. Above are shown many production castings, including parts for textile machinery, marine engines, bottle washing machines and steam traps.

When You Design Aluminum Bronze Permanent

BY ARTHUR STREET, Ph.D.

ALUMINUM BRONZE is the strongest alloy that is commercially cast in permament metal dies. Even the simple alloy B-148-42.T. containing about 10 percent aluminum, 1 percent iron and the balance copper, provides a tensile strength of about 80,000 psi, with an elongation on 2 inches of about 35 percent. With greater additions of iron, plus nickel, the tensile strength approaches 100,-000 psi, though the elongation drops to about 10 percent.

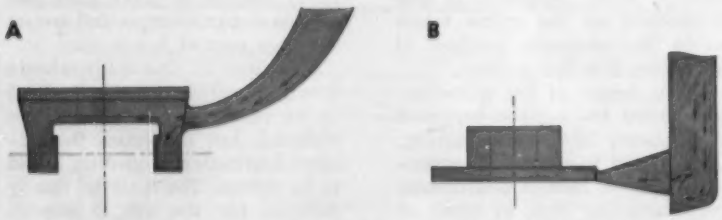
Bevel gears, components of cranes and of automobile gear change mechanisms, illustrate the strength of alumium bronze permanent mold castings.

Aluminum bronze has an attractive golden colour and it possesses the valuable property of great resistance to most forms of corrosion. Thus, aluminum bronze is used in steam traps, parts of textile machinery, bottle washing machines and components of marine engines. Figure 1 shows some typical aluminum bronze permanent mold castings.

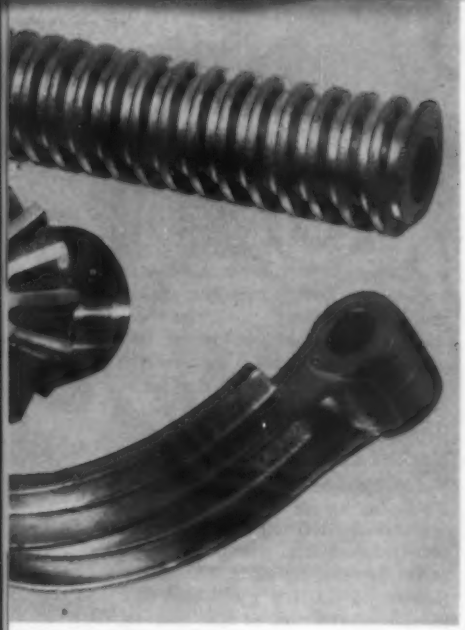
To get the best results, aluminum bronze must be cast in a tranquil condition, to avoid the entrapment of aluminum oxide in the molten alloy. The experiments of such early workers as Durville showed that the more freedom from turbulence the better the quality of aluminum bronze castings.

In good permanent mold design the runner is shaped so that the molten metal travels smoothly into the die, preferably feeding the heaviest section. A type of runner that provides the tranquil flow which is needed to make

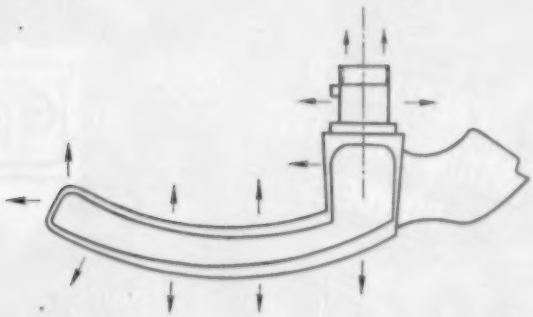
RUNNER DESIGN INFLUENCES CASTING QUALITY



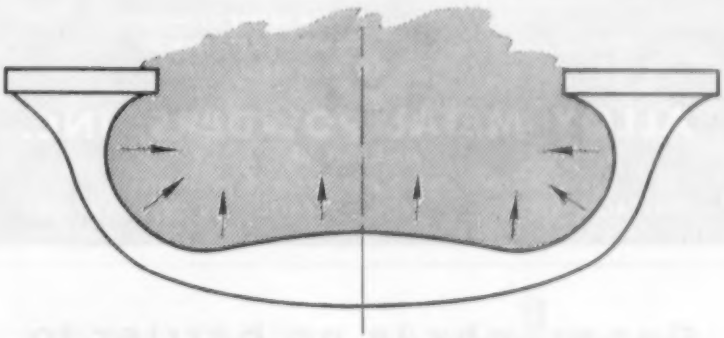
2. **SMOOTH INFLOWING METAL** is one of the keys to successful casting of aluminum bronze. The horn runner (A) enters near the lowest point of the casting so that molten metal can rise steadily without trapping air. Where design of the component forces the die designer to apply a "runner block" design (B), there is greater likelihood of porosity trouble because of greater turbulence in the metal flow.



HEAT FLOW IN MOLDS SHOULD BE CONSIDERED



3. DIRECTION OF HEAT FLOW is indicated by arrows in this simple door handle casting. When the molten alloy is cast, portions of the mold nearest casting are rapidly brought up to red heat and must be dissipated quickly and evenly. Heat escapes readily in direction of arrows, allowing mold to cool uniformly, and prolonging mold life.



4. IRREGULAR HEAT CONCENTRATION in this mold, especially where the curved portion of the door handle practically surrounds a part of the mold, will shorten the life of the mold. Where heat escape is restricted, the mold section will work at higher temperature, resulting in uneven expansion and contraction and early mold breakdown. Hair cracks will show by the end of 5,000 castings, whereas the mold shown in Figure 3 might last to 15,000 pieces.

Mold Castings

satisfactory aluminum permanent mold castings is illustrated in Figure 2A.

Any producer of aluminum bronze permanent mold castings must be prepared to allow for a high cost of mold maintenance, often amounting to as much as a quarter of the total cost of production labour. The die must be made in such a way that those parts which are liable to rapid wear can be replaced cheaply. The problem is linked with the need for rapid and even escape of heat from the working parts of the die, as demonstrated in Figures 3, 4 and 5.

In some designs a replaceable block can be let into the mold, at the danger point, and removed as soon as it shows harmful signs of wear. Thus for example, the main body of the mold for the bevel gear shown in Figure 1, lasts for over 15,000 castings, but the block containing the form of the teeth is replaced about every 5,000 cast-

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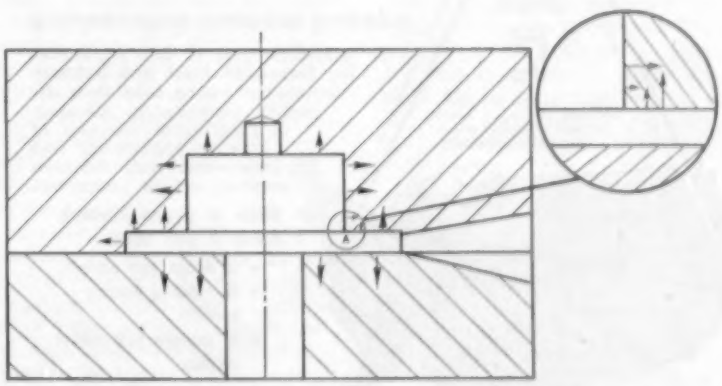

5. DIE WEAR WILL BEGIN at section A, shown enlarged, but where such early failure is likely to occur, the designer can provide a minimum radius angle. Soon, die wear begins at this point and, when hair cracks appear, the angle can be ground to increase the radius. This can be repeated until the maximum allowable radius is reached. Many thousands of extra castings can be made, provided the radius can be increased to as much as ¼".

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Aluminum Bronze — Cont.

ings. Similarly one portion of the automobile windshield pillar shown in Figure 2, uses a replaceable block which forms the curved portion, and that is renewed several times during the life of the mold.

Unfortunately, the use of replaceable blocks is somewhat limited since there is a danger of the molten aluminum bronze penetrating the gaps between the blocks, causing the casting to stick in the mold, leading to slow output.

Careful attention is paid to the construction and choice of material for the cores in aluminum bronze permanent mold castings. In the production of the casting, the cores will be surrounded by molten metal and often work red hot, since the heat can only escape along the axis of the core. High alloy steels or special heat-resisting alloys are generally used but even so core wear is an ever-present menace.

In recent years much has been done with the use of the nickel-chromium alloys of the Nimonic type, such as are used in jet aircraft. One typical aluminum bronze permanent mold casting for the motor trade contains a 1" diameter cored hole, produced at first by a tungsten steel core, which had a life of only 500-1,000 castings. Then Nimonic alloy was used for this core and a life of over 3,000 castings was immediately obtained, thus saving considerably on the cost of replacement.

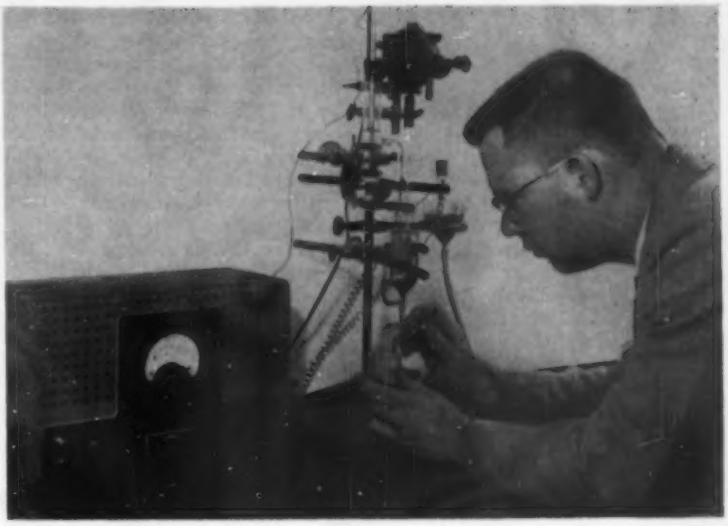
The Nimonic type of material is fairly easy to turn, and thus its use for round cores is practicable. The material is however difficult to mill and on that account its use for form cores is sometimes not practical.

Furthermore, the Nimonic has to be used with caution, even for round cores. For example, if the incoming molten metal falls directly onto a Nimonic core, embrittlement of the core may result, leading to a disappointingly quick breakdown, but if the runner is arranged so that the molten alloy runs smoothly around the core, long life is obtained.

Any engineer who reads the die casting literature will agree that many hundreds of thousands of words are written about the die casting of alloys of low and medium melting point, but there is much less information about the

Continued on page 76

TECHNICAL REPORT



ANALYSIS OF ZINC ALLOY solution at the National Bureau of Standards using an electrolysis cell with a mercury cathode at controlled potential. The trace metals in the solution are withdrawn into the mercury pool leaving the zinc in solution. After electrolysis, the zinc solution is replaced by a fresh electrolyte and the metals selectively removed from the mercury by anodic dissolution for quantitative determination. The anode of the cell is a platinum gauze cylinder. The motor-driven stirrer (above) minimizes concentration-polarization effects at the solution-mercury interface. The potentiostat (left) automatically maintains the cathode potential with respect to a calomel reference electrode (dipping into solution).

Die casters and users of die castings will welcome this

New Way To Check Trace Elements In Zinc

THE National Bureau of Standards has developed an electrolytic procedure for precise determination of very small amounts of impurities in zinc and zinc-base alloys. The procedure does not require preliminary separations, is relatively fast, and requires little operative attention. It should also be useful for analysis of other metals as well as zinc, particularly non-ferrous alloys.

Developed by J. K. Taylor and S. W. Smith of the Bureau's physical chemistry laboratory, the method makes use of electrolysis at controlled potential, a technique which is finding increasing use in selectivity separating the metallic constituents of a solution.[1] Unlike previous methods, the Bureau procedure deposits the metals in a mercury cathode from which they are selectively removed by anodic dissolution for quantitative determination.

Zinc is one of the more important metals commercially: sheet metal products are galvanized with spelter (99 percent zinc); zinc-base die casting alloys have the advantages of low cost and low melting point. Thus industry as well as science is interested in the physical properties of zinc alloys.

These properties are a function of alloying and trace metals like copper, lead, tin, and cadmium. Generally, the presence and quantities of such metals in zinc-alloys are conveniently and accurately determined by polarographic analysis—a method based on interpretation of current-voltage curves obtained during electrolysis of an alloy solution. However, copper and zinc, when present in relatively large quantities, interfere and cause inaccuracies in the results.

Conventional polarographic methods are limited, even for alloys of very low copper content, when small amounts of other trace metals are to be determined. In such cases, the sample of the alloy to be tested is usually dissolved in a minimum volume of solvent so as to insure maximum concentration of trace elements in the test solution. Although this procedure increases the test sensitivity, the small volume of solvent used limits the size of the sample that can be tested.

In the method developed by the Bureau, the sample is dissolved in an electrolyte and placed in an electrolytic cell. A mercury-pool cathode in the base of the cell is connected through a stopcock to a mercury reservoir. The anode is a platinum gauze cylinder inserted at the top of the cell. The solution to be analyzed is electrolyzed at a potential which allows zinc to remain in the electrolyte but withdraws copper, tin, lead, and cadmium into the mercury pool.

When electrolysis is complete, the residual zinc solution is discarded and replaced by a fresh electrolyte. Electrolysis is then resumed at a lower potential chosen to redissolve the trace elements, singly or collectively, from the mercury. The solutions obtained are then analyzed polarographically with no interference from zinc.

The Bureau method of separating the metal constituents by means of a mercury-pool cathode

Continued on page 77

SINTERED STEEL

continued from page 51

drawing are somewhat closer than the powder metallurgist likes to work to, they can be met by a coining operation.

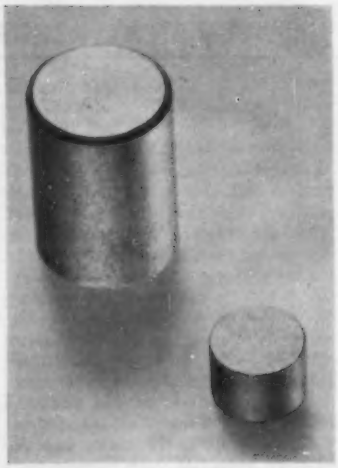
Angular relationship between the keys is important and must be held to ± ½ degree.

As these parts are received from the fabricator, they are completely finished and oil impregnated. Accuracy is so good from part to part and within any single part that rejections have dropped to almost zero. Experience has shown that, when the pieces selected for inspection fail to pass, almost invariably the entire shipment will have to be rejected. This would indicate human error in the manufacture of the parts rather than any factor attributable to the method of manufacture.

Assembly of the pulley assembly is simplified by the use of the powdered metal insert. The die cast pulley is made with slots to receive the external keys molded on the spline insert. A small interference is allowed so that the insert may be pressed snugly into place (see Figure 2), but not enough to cause collapse of the porous structure. With the older method of construction of the pulley assembly, the spline insert had a smooth outside surface which offered little purchase when pressed into the die cast pulley. Staking was then used to hold the insert in place. Thus the powdered iron insert gives a more positive drive, and also eliminates the staking operation during assembly.

Through continued use some play is bound to be developed by the quill. Generally the adjustment provided to take up this play is a set screw which bears against the steel quill or on a phosphor bronze plug. Through this arrangement, wear on the quill can be increased materially. To prevent excessive wear and to give a "softer" bearing surface, a powdered iron or brass plug that has been oil impregnated is used between the quill and the set screw. These plugs are made in several different sizes by the Boundbrook Oil-Less Bearing Co. Lengths vary from ¼" to 13/16" and diameters from ⅜" to 0.687. On the smaller sizes, dimensional accuracy is held to only 1/64" but on some of the others the diameter, particularly, must be held to as little as 0.001 total variation.

By the change to powdered iron or brass instead of phosphor bronze, a superior product at a lower cost was secured.



SINTERED BRONZE PLUGS that bear against polished machine parts furnish adequate locking without any danger of scoring the finished steel. By oil impregnation, an adequate degree of self lubrication is assured.

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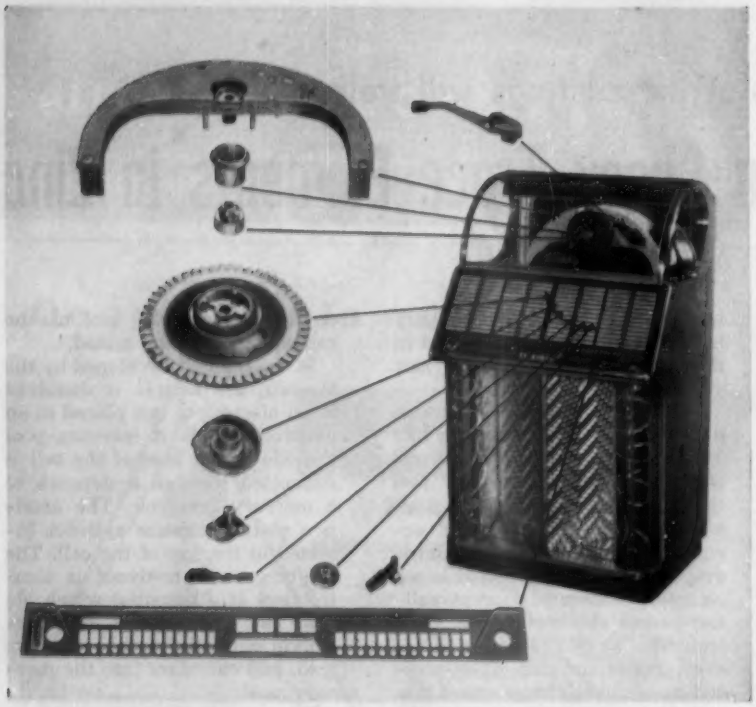

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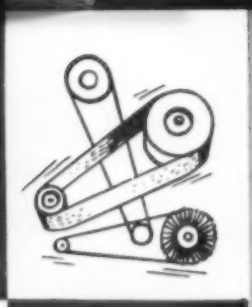
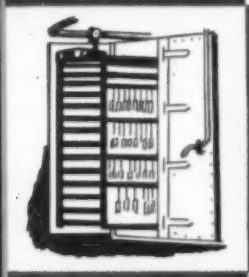

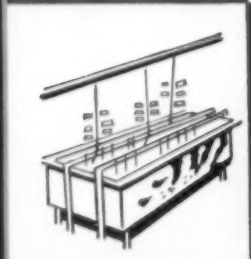

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Finishing Section

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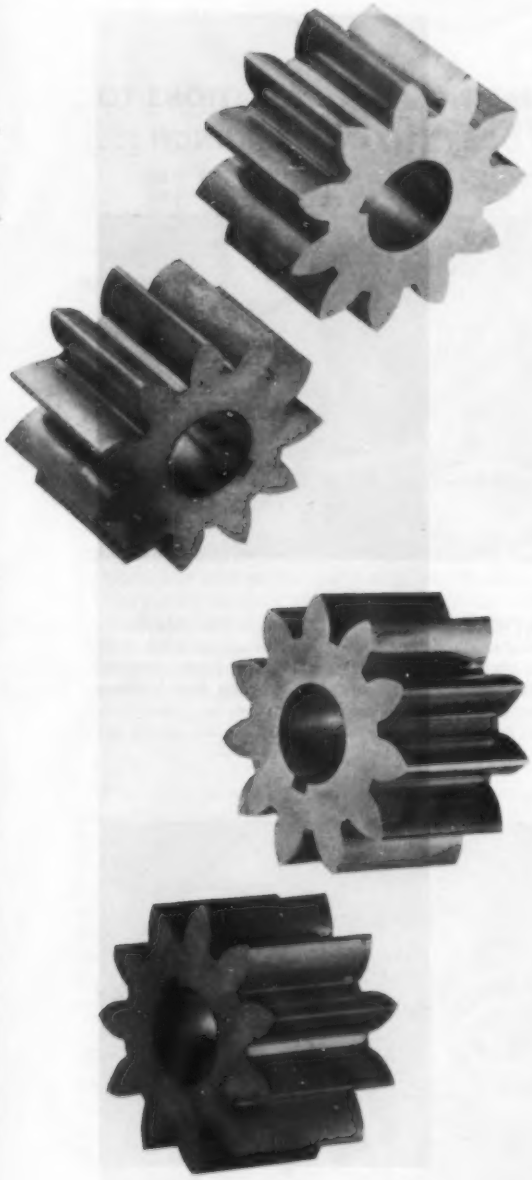

How We Grind Powdered Steel Gears to 4-6 Microinches

. . . to meet the operating requirements of high pressure hydraulic pumps at costs about 1/3 lower than for comparable gears cut from wrought stock.

BY ARTHUR ROBERTS, President
AA Specialty Gear Co.

THE basic requirements of a gear to be used in a high pressure hydraulic pump are accuracy of tooth contour, pitch diameter, outside diameter, bore diameter and length. The faces must be parallel to each other and exactly at right angles to the bore. Further, the pitch diameter, outside diameter and bore must be perfectly concentric and the surface finish throughout must be excellent.

When gears are made by one of the usual methods of generation, it is frequently necessary to match pairs that are to run together. Due to tool wear and the fallibility of machine operators, the number of gears that must be rejected is relatively high.

Powder metallurgy, on the other hand, has shown itself able to overcome some of these difficulties. Because it is possible, for only a small additional expense, to achieve an almost perfect tooth profile in the die and a highly accurate pitch diameter, these two sources of error can be almost eliminated. By making dies of the proper material, tool wear becomes negligible, eliminating another cause of rejections. Finally, because the process is, for the most part, relatively independent of human error, this source of faulty gears is greatly reduced.

On the other hand, outside diameter, bore and length are more difficult to control as accuractely as desired, when powder metallurgical methods are used. In many cases, grinding has been resorted to as a finishing operation on powdered iron gears. While grinding can produce a finished gear of the desired dimensional tolerances, the surface finish generally left much to be desired and concentricity was seldom acceptable.

By grinding methods developed by the AA Specialty Gear Co. it is now possible to produce finished gears for high pressure hydraulic applications that retain all of the

Continued on page 60

HERE ARE THE FOUR OPERATIONS TO GRIND GEARS TO 4-6 MICROINCH . . .

OPERATION 1. Face one end. For this work, a Heald rotary surface grinder is used with the parts fixtured so that the face being ground is held exactly perpendicular to the pitch line of the teeth. Carborundum wheels are used for this grind and the coolant is Lusol, diluted about 70:1.

OPERATION 2. Grind the bore, reference is again made to the pitch diameter. For this work, a Heald 72A internal grinder is used with a Heald Red Head wheel head. A specially designed chuck must be used that assures rotating the gear about an axis that is precisely concentric with the pitch diameter. Depending upon the wheel being used, the speed will vary from 7000 to 25,000 rpm. The coolant is the same as was used for the first surface facing operation.

The important feature of this grinding operation is in the chuck used to hold the gear. As noted, it grips on the pitch diameter and thus, automatically, the bore is ground concentric with the reference diameter and at right angles to the previously ground face.

Bore measurements are made with a Sheffield Precisionaire gauge that is sensitive to 0.00005. Total tolerances on the bore are about 0.0002.

OPERATION 3. Face the other end. For this operation, a Heald rotary surface grinder is again used with a precision ground magnetic chuck. Speeds, feeds, coolant, etc., are the same for this grind as for the first surface facing operation. Here length tolerance is important. Gauging to 0.0001 is done with a precision dial gauge set and calibrated with standard gauge blocks.

OPERATION 4. Grind the outside diameter of the gear. For this operation, the gear is mounted on an accurately machined arbor in a Cincinnati external grinder. As in all other operations, a Carborundum wheel with Lusol coolant is used. As an indication of the finish achieved in these grinding operations, the wheel used here is a 60-L and gives a finish of from 4 to 6 micro inches RMS.

We Grind Powdered Steel Gears — continued

advantages of parts made from metal powders and have all of the dimensional accuracy and fine surface finish that is required for this service.

A group of rough and finished oil pump gears are shown on page 59. The rough gears are produced by the Amplex Div. of the Chrysler Corp. in steel Oilite with a density of 7.0 g/cc. As finished by the fabricator, the gear material has a minimum ultimate tensile strength of 120,000 psi and a hardness of 60 Rockwell C. The

Continued on page 62

(Advertisement)

SPECIAL REPORTS ON FINISHING NON-FERROUS METALS

NUMBER I—Decorative, Corrosion-Resistant Finishing with Iridite

Chromate conversion coatings are well known and accepted throughout industry as an economical means of providing corrosion protection, a decorative finish or a good paint base for non-ferrous metals. However, continued developments are so rapid and widespread that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this digest of current information; to bring you up to date on the many ways in which you can combine salable appearance with durability in one finish at a competitive price advantage. Report II on paint base, corrosion-resistant finishes and Report III on chemically polished, corrosion-resistant finishes are available on request.

First, as a basis for this discussion, a "decorative" finish is considered as any chromate film that is used as a final finish in itself. It may be truly decorative in that its sole purpose is to enhance the beauty of the product. For example, a bright chrome-like finish or a pleasing bronze appearance are among the many effects that can be obtained. It may be functionally decorative in that it reduces reflectivity for camouflage purposes or provides a means of color-coding parts. But, in all cases, the Iridite films protect the metal against corrosive attack.

Iridite finishes are now available for all commercial forms of the more commonly used non-ferrous metals, including zinc, cadmium, aluminum, magnesium, silver, copper, brass and bronze. These films can produce a wide variety of pleasing appearances. The basic colors of the Iridite coatings are grouped below by metals.

ZINC and CADMIUM: Metallic bright, light iridescent, iridescent yellow, bronze, olive drab.

COPPER, BRASS, BRONZE: Metallic bright, yellow.

ALUMINUM ALLOYS: Clear, iridescent yellow, brown.

MAGNESIUM ALLOYS: Metallic bright, iridescent yellow-red, brown.

SILVER: Metallic bright.

In addition, many films can be modified by bleaching or by dyeing. Among the dye colors available are various shades of red, yellow, green, blue or black.

Depending upon the metal and the Iridite used, corrosion resistance of clear and bright films ranges from mild passivity to as high as 500 hours in salt-spray; on heavier dark films, salt-spray resistance ranges from approximately 100 to 1000 hours.

It is this combination of decorative and corrosion resistant properties that accounts for the widening use of Iridite finishes. For example, Iridites #4-73 and #4-75 (Cast-Zinc-Brite) make possible for the first time, a combination of lustrous chemical polishing of the as-cast surface of zinc die castings and good resistance to corrosion. Further, in many cases, sizeable savings in the cost of buffing and electroplating are realized.

On many steel parts, a simple system of zinc or cadmium plate and bright Iridite is used instead of more costly electroplated finishes to provide a bright, decorative and protective finish with tremendous savings in material, equipment and labor.

In finishing aluminum, where corrosion resistance or paint adherence is the prime consideration, the aircraft industry has all but abandoned the anodizing process in favor of recently developed chromate conversion coatings, among them Iridite #14 and #14-2 (Al-Coat). These formulations and their method of application can be varied to retain the original metallic appearance while providing acceptable corrosion resistance, or to produce a fully colored brown finish that offers exceptional corrosion protection. Again, time and manpower savings are astounding—one company saved at least $15,000 a year on maintenance of racks alone and another $40,000 on materials and labor in only nine months. In addition, of course, hundreds of thousands of dollars are saved by eliminating the need for expenditures for generators, heating equipment and racks.

Iridites are widely approved under both Armed Services and industrial specifications because of performance, low cost and savings of materials and equipment.

In planning or designing, you should consider the many other characteristics of Iridite finishes which may enter into the specific problem. In addition to having decorative and protective functions, these chromate coatings form an excellent base for organic finishes and bonding compounds. They have low electrical resistance. Some can be soldered and welded. The Iridite film itself does not affect the dimensional stability of close tolerance parts.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product requires the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 E. Monument Street, Baltimore 5, Maryland.

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

For more information circle No. 66 on the Reader Service Card

tooth contour is an almost perfect involute and the pitch diameter is held to less than 0.001 total error. The surface finish of the part, as delivered by the fabricator, is about 14 microinches, RMS.

Gears of the type described have been used, after precision grinding, for service up to 2500 psi. Where service up to 3000 psi is required, a plastic impregnating operation must be employed to fill the slight residual porosity in the metal so that notch effects due to minute voids is reduced.

While the powder fabricator is able to hold tooth contour and pitch diameter close enough for any service and the smoothness of tooth surface is adequate, it is not possible to hold other dimensional tolerances to the degree required. For example, on the outside diameter, finished tolerances of ± 0.00015 are commonly required and on length a finished total variation of less than 0.001 is usual. Final grinding must, therefore, be done to secure the required accuracy.

Well made powdered metal parts can be ground about as easily and to as fine a finish as parts made from wrought stock. A surface finish of 4 micro inches, RMS, can be achieved readily. Wheel speeds (in surface feet per min.), parts speeds (when rotated), depth of cut per pass, etc., are about the same as for wrought stock of the same composition. (In this case, the same as if grinding either 8620 or 4615 steels.)

Tooling Costs...$3500

Generally, a slightly finer grit wheel with a harder, vitrified bond is required and a somewhat different coolant is used. For most powdered iron parts of this character, a synthetic water soluble coolant diluted about 70:1 is employed. Slightly more rust inhibitor than usual is used and the coolant is applied by flooding.

Because the critical dimensions must be ground, it is customary procedure to allow approximately 0.010 clean up on the OD, bore and length. To finish a gear, the sequence of operations is:

1. Face one end.
2. Grind bore.
3. Face other end.
4. Deburr.
5. Grind OD.

Since the gears operate on the pitch diameters, it is obvious that all grinding operations must be set-up so that all finished surfaces are in the proper relationship: parallel to, perpendicular to or concentric with the pitch diameter.

Generally speaking, it is slightly more expensive to grind these gears than those cut from wrought stock. This is not because it is more expensive to grind powdered metal parts, but rather because of the required sequence of operations results in one extra operation.

Tooling costs are about $3500 for a gear of given pitch diameter and number of teeth. However, when gears of different length are needed, if they are designed with the same number of teeth and the same pitch diameter, a single set of tools will often be used for

Continued on page 64

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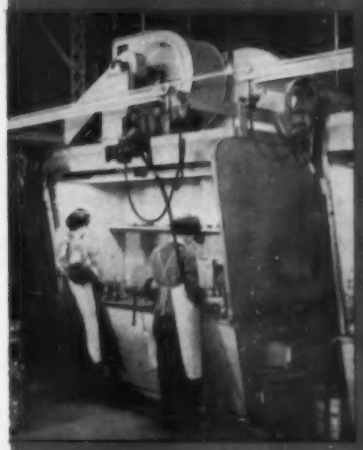

PETERS-DALTON *Hydro-Whirl* WET TYPE DUST COLLECTORS

For the proper and safest method of collecting highly inflammable dusts, fine chips and grindings, the Wet Method is BEST. Peters-Dalton Hydro-Whirl Wet Type Dust Collectors are efficient in operation . . . low in price . . . and provide maximum safety to plant and personnel, particularly during what can be hazardous operations, such as grinding, polishing and buffing magnesium alloys.

Illustrated here are four types of PD Wet Type installations. *Upper left*—well ventilated bench for the safe collection of dust produced from portable tool and flexible shaft grinding, polishing and buffing; *upper right* — dust collector for grinding stands and polishing jacks; *lower left* — water-wash type spray booth for removing noxious fumes created while spraying oxidation inhibitors containing fluorides or other toxic compounds on cores; *lower right* — high velocity side hood wet collector for dust, fumes and smoke during a foundry "shakeout" operation.

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how to treat ZINC DIE CASTINGS

for appearance and protection without plating

Bright clear finishes **can be produced in a cold, highly stable, acid solution in 15 seconds. Gives excellent corrosion protection or can be used as a base for clear lacquering. This treatment also produces bright iridescent or golden brown color by varying the cycle or concentration of the solution. Specify KENVERT #50.**

Olive drab film on zinc castings for protection and appearance can be produced in a highly stable bath. ***Uniformly reproducible.*** **Offers maximum corrosion protection and a good base for paint. Specify KENVERT #51.**

It will pay you to investigate KENVERT Chome Sealer bright or color films immediately. Our laboratory is ready to consult with you or treat samples at no obligation.

CONVERSION CHEMICAL CORPORATION

101 East Main Street Rockville, Conn.

Circle No. 69 on Reader Service Card

POWDERED GEARS

continued from page 62

several different lengths. Further, when short gears are needed, a single long one can be made and then thin slices taken off. It is of interest to note that when this slicing technique is used, there is no appreciable difference in density or physical properties from piece to piece cut from the same longer part.

When as few as 2500 pairs of these precision ground gears are used per year the savings that result from fabricating from metal powders lowers the finished cost by about 33 percent.

HEADS HELI-COIL

Heli-Coil Corp. recently announced the appointment of Eduard Baruch as president, Walter Mann as executive vice-president, and John Tucker as assistant secretary and treasurer.

Mr. Baruch served as vice-president and director since 1951, and as executive vice-president since last November.

Louis R. Ripley, company president for six years, is the new chairman of the board of directors.

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FREDERICK GUMM

Chemical Company Inc.

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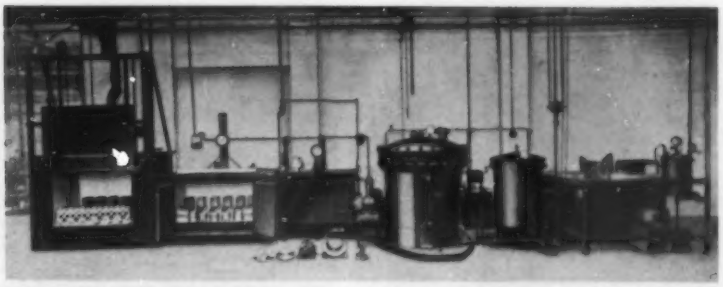

SET-UP FOR IMPREGNATING as installed in the Reading plant of Pulsometer, is shown here. Close control of time and temperature are critical factors.

A war-time expedient has become a production process for salvaging thousands of porous castings by this

New Method Of Impregnating

A PROCESS for the impregnation of castings, recently introduced in England for the sealing of porous castings, has been successfully applied to bronze, gunmetal, steel, cast iron and aluminum castings. Size of castings to which the new system has been applied ranges up to several hundred pounds, including highly finished engine castings. Suction and delivery covers of pumps, weighing more than a half ton each have also been impregnated, withstanding pressures up to 1200 psi afterwards.

The special process, called the Pulsometer Process, was developed by the Pulsometer Engineering Company and was originally conceived as an expedient to save some of its own castings which had been shown to be porous under pressure tests.

During the war years, especially, when speed as well as efficiency was essential, this system was employed to cut down on delivery times in order to meet urgent deadline. It is now being used commercially both by Pulsometer and other companies.

How It's Done. This special process consists of the vacuum impregnation of the casting with a phenolformaldehyde, Bakelite, solution. Castings are first placed in a gas-fired oven and raised to a temperature of 135 C for at least one hour in order to dry them out.

They are then transferred to an autoclave in which they are subjected to a vacuum of about 28 inches of mercury. The castings remain at this reduced pressure for about 10 minutes, after which the Bakelite solution is introduced, the vacuum being maintained.

A five-minute period is allowed for soaking and then the vacuum pump is shut off and the autoclave opened to the atmosphere. Air pressure is then applied, thus forcing the solution into the evacuated pores with a differential pressure of up to 80 psi, according to the size and type of castings being processed.

After 20 minutes, the release valve is opened and the Bakelite solution is allowed to drain back to the reservoir. The castings are then removed from the autoclave, washed with thinners, and placed in an oven for curing. The process is rigidly controlled with regard to temperature and time.

This service has now been made available to other companies, and installations have been set up to process thousands of pounds of ferrous and non-ferrous castings. Pulsometer also processes castings in its own factory, Nine Elms Iron Works in Reading, England, and processes sample castings for overseas firms preliminary to installing impregnation equipment in their own plants.

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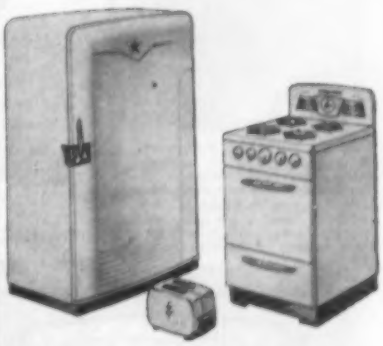

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ICE FLAKER

continued from page 39

teeth of the blade and permits reduced machine operations. Shell molds are also made on a Shalco machine. Cores are set into the mold and the entire assembly is cemented with a phenolic adhesive.

Castings are poured horizontally in high strength manganese bronze. Gates are sawed after cooling and shake out.

Finishing the casting is a simple operation: tips of the cutter blade teeth are form milled to insure a ± .002 alignment of the edges and a land width of 1/32" + 1/64 -0. Flanks are dressed to remove any excess flash and holes of the gate are ground smooth; casting is then given a final shot blast.

Capable of producing from 1000 to 2000 lbs. of flaked ice per 24 hours, this Carrier ice making machine uses the economies of shell mold cast parts to cut production costs.

ICE IS PRODUCED in a vertical cylinder which is wrapped in refrigerant coils covered with 1¾" cork insulation. A curtain of water flowing down the inside surface of the cylinder builds up a thin film of ice. An arc in the slowly turning water distributing plate blanks off the water flow, thereby permitting the ice ahead of the ice removal blade to sub-cool to 14°. The ice cracks as it sub-cools and is harvested by the scraper. Flakes drop out of the bottom of the cylinder into an insulated storage bin below, ready for immediate use. Carrier's flake ice makers are either water or air cooled with capacities ranging from 1,000 to 2,000 pounds of flaked ice every 24 hours.

Scraping blades of the assembly also involve the same shell molding techniques. This casting is finished by grinding the gate and dressing the cutting lip to the required 30° angle.

Both blades were previously built up by plating with copper, nickel and chrome. Now, cast parts are chrome plated only to provide long wearing tooth surfaces.

SHAPES UNLIMITED

continued from page 46

Tolerances. These vary with the shape and size of the piece, but can be held to limits in the order of ±.002/inch without difficulty. On selected dimensions, some components have been held as close as ±.001/inch, the company says.

Quantities. The first pilot model of a particular component may cost less than its fabricated counterpart, and hence, a single piece may be economically feasible. On the other hand, quantities of 25 to 500 are routine and certain jobs have been run in quantities ranging into four figures.

Inserts. Inserts of certain materials can be cast in place with relative accuracy of location. These include ceramics and other non-oxidizing materials.

Advantages. Three main reasons for using this special type of casting are listed as: 1) To reduce the cost of making complex items, especially those that are now being fabricated from sheet metal or a number of smaller elements; 2) To permit the use of magnesium for many components where it is the preferred material, but where fabrication difficulties have prevented its application; and 3) To make shapes not otherwise practical.

You polish with the "Touch of Gold" when your wheels or belts are coated with ALUNDUM® abrasive. This extremely hard, sharp grain cuts fast, clean and cool. And the Norton special high capillarity treatment means easier wetting with cement or glue — for maximum adhesion, longer wheel life and better polishing performance.

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BRASS MANDREL shown here was used to machine the high chromium-nickel die at the right. Notice end erosion of the electrode which, in this case, was not hollowed for coolant circulation. Time of machining was 1 hour and 15 minutes, including 12 minutes for roughing.

DRAWING DIE has been cut with the brass mandrel shown at the left. The high precision of machining is apparent in sharpness of edges and angles. Tolerances met are reported to be ± .0005. The material is .400 thick. No pre-drilling was done to prepare the hole.

PLASTIC HALF MOLD for compression molding of telephone handle was roughed out on a flat, heat treated steel block in 2¾ hours; finished in another 3½ hours.

FLAT STOCK was pierced and engraved with two mandrels shown at the left, above. The piercing through of the letters SEL was done in the 3/16" stock in a total of five minutes.

Dies Can Be Machined By Molecular Erosion

Removing metal by means of an electric spark is the basis for this process used to machine hard or unmachineable materials. One important application has been the cutting of dies and tools having irregular contour. Due to the nature of the process, a soft material, like brass, that can readily be machined into the desired shape, is used as the cutting electrode.

The process, illustrated above, uses an Abaco electronic machine which is capable of removing 3 cubic inches of material per hour on a surface as large as 50 square inches. The unit consists of a high frequency generator and a machine that looks like a conventional jig borer. The 4½ KW machine has four speeds: roughing, semi-finishing, finishing and micro-finishing, controlled by means of a button.

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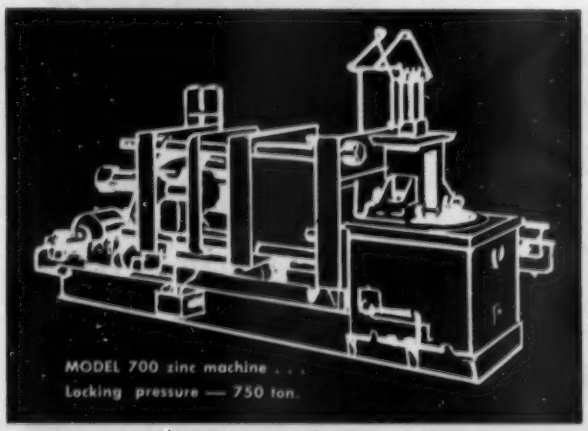
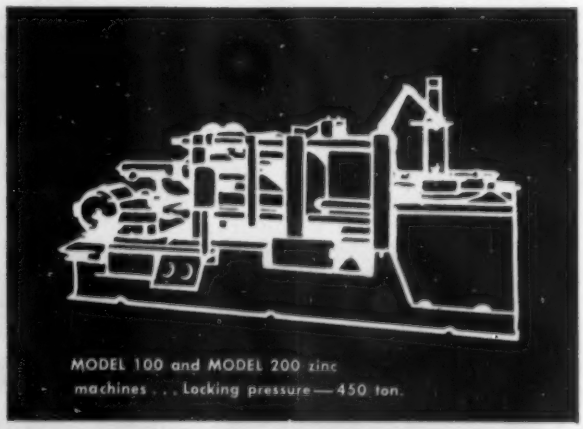
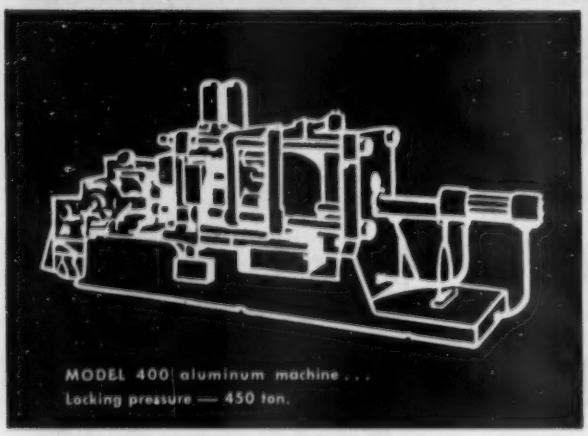


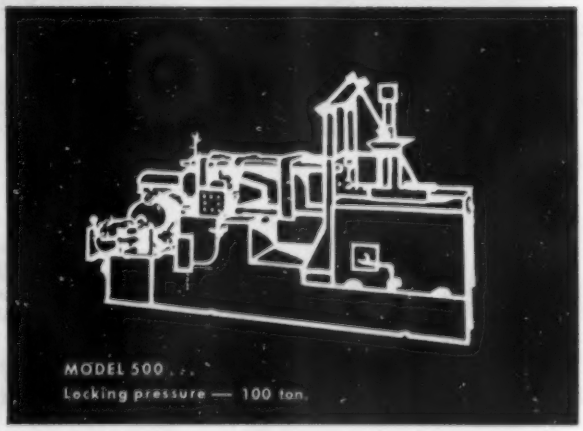
MODEL 700 zinc machine . . .
Locking pressure — 750 ton.



MODEL 100 and MODEL 200 zinc machines . . . Locking pressure — 450 ton.



MODEL 400 aluminum machine . . .
Locking pressure — 450 ton.



MODEL 500 . . .
Locking pressure — 100 ton.

B&T die casting machines operate with four extra heavy alloy steel casting toggles that lock directly under the tie bars. The hydraulic lines are of extra heavy seamless pipe; Weldon joints, flanged connections and "O" ring seals on pressure lines. Full specifications on all models furnished upon request. Consult with us on your requirements.

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USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the appropriate numbers on the Reader Service Cards, Pages 16-17

PROCESSES

Meehanite Metal Castings: 154
Meehanite Metal Corp., 6-page article. The booklet illustrates the basic characteristics and specifications of Meehanite metals. Graphs explain the relation between stress and strain on the metal and show its tensile strength and hardness.

Shell Molding Operation: 155
Plastics Engineering Co., 24-page brochure. The shell molding process, from raw materials to finished product, is explained. Advantages of shell molding are listed and suggestions on material usage and recommended resins are given. A service guide is included to help solve fundamental shell molding problems.

Shell Molding Techniques: 156
General Electric Co., 27-page, 2-color manual. This publication provides foundrymen and castings users with a practical handbook for the production of shell molding and castings. The fundamental steps of the shell molding process are explained with the use of photos. Production data is given and new company testing methods and procedures are described.

Shell Processing Machinery: 157
Beardsley & Piper Div., Pettibone Mulliken Corp., 16 pages, bulletin No. 6000. Latest developments in shell processing machinery for shell sand preparation, shell molding, and shell coremaking are described in the new catalog. Complete descriptions, diagrams, specifications, photographs, engineering data, and construction features of the company's newest machinery are reported.

Beryllium Copper Engineering Data: 158
American Silver Co., Inc., 4-page data sheet, No. A-300. This new technical sheet gives the engineering specifications on several of the more widely used beryllium-copper alloys, including complete physical properties and the effect of heat treatment on these properties. A section detailing the specific methods for heat-treating the metal is featured.

Stainless Steel Castings: 159
Crucible Steel Co. of America, 19-page, 2-color brochure. This booklet contains a detailed description of the production of the company's heat and corrosion-resistant stainless steel castings. Miscellaneous data on the castings are available as well as tables on the composition and properties of the various cast grades produced. Typical applications of the stainless grades are listed with photos of various types of the new process casting.

How To Select Sintered Materials: 160
Bound-Brook Oil-Less Bearing Co., 2 pages, 4-color folder. This chart enables the reader to select the proper material for sintered bronze or iron bearings. The complete chemical, mechanical, and work characteristics of a wide range of sintered bearing materials are shown by means of a three-color chart.

MATERIALS AND EQUIPMENT

Hydraulic Fluid Filters: 162
Marvel Engineering Co., 3 catalogs. Up-to-date engineering data and dimensional charts for all sizes of hydraulic fluids and water filters are presented in these revised catalogs. Catalog No. 200 contains complete data on filters for fire-resistant hydraulic fluids.

Tool Steel Problems: 163
Wiedemann Machine Co., 2-page pamphlet. Possible solutions to shrinkage and expansion problems caused by heat treating of tool steel are provided in this short publication. Helpful suggestions from tool steel suppliers have been incorporated into the pamphlet.

Lubricant Applications: 164
La France Mfg. Co., 2, 1-page bulletins. Descriptions and methods of application of two new lubricants are contained in these technical sheets. One of the lubricants has been developed and manufactured specifically for the lubrication of plungers on die casting machines and has a minimum flash point of 480 F. The other is used for die casting of aluminum alloys. Price listings for both lubricants are included.

Cements For Industrial Tooling: 165
United States Gypsum Co., 8-page bulletin No. ITT-100-F. Fundamentals and industrial application of loft template tooling used by the aircraft, automotive, plastics, and foundry industries are explained by a series of step-by-step photographs. Advantages of making master models by this method are discussed.

Indication, Control Instruments: 166
General Electric Co., 2-pages, bulletin GEC-1324A. Technical bulletin describes features, accessories, applications, specifications, and special calibration of instruments for temperature indication and control of industrial processes.

New Thickness Gage: 167
General Electric Co., 4 pages, bulletin GEA-6458. This folder tells of a recently developed, permanent-magnet thickness gage designed for thickness measurements of nonmagnetic coatings, such as a point or plating, on magnetic iron or steel. A list of typical applications where the gage can be used accurately is also given.

Dual-Fuel Burners: 168
North American Mfg. Co., 4-page, 2-color bulletin 214; 4-page sheet DF-214. The first folder describes the company's series 214 gas and oil burners and shows photos of burner installation. The second sheet gives burner capacities, dimensions, etc.

Foundrymen's Booklet: 169
Whiting Corp., bulletin No. FY-175. Illustrated, pocket-size booklet provides practical data pertaining to various foundry operations. Information concerning cupolas, electric furnaces and transformers, fuels, ladles, melting points, temperatures, and weights is included. Explanatory material with convenient reference tables is provided as well as space for working notes near the tables.

Low-Hydrogen Electrodes: 170
General Electric Co., 3 pages, bulletin GED-3048. Features, deposition rates, and properties of low-hydrogen, powdered metal electrodes produced by the company are revealed in the folder. Also included is a specifications chart for the two electrodes.

Solution To Dust Problems: 171
Torit Mfg. Co., Dept. KP booklet No. 56. This envelope-sized booklet describes the principles, advantages, and savings of unitized dust collection. Illustrated with cartoons, cutaways, and products photos, it describes dust damage, contains general product information, and discusses uses and reductions in operational expenses. A photomicrograph of various types of industrial dust is also included.

Continued on page 70

Listed below are some of the operations discussed in Oakite's 44-page handsomely illustrated booklet on Metal Cleaning. Please check the list. Then let us show you how Oakite methods can give you better production with greater economy.

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USEFUL LITERATURE

continued from page 69

Ladling Processes For Aluminum: 172
Lindberg-Fisher Div., Lindberg Engineering Co., 1 page, technical bulletin No. 570. A full description of the company's new automatic ladling unit for aluminum is offered in this bulletin. The sheet also lists technical data for use of equipment for fully automatic processing of many types of casting, especially aluminum die casting and permanent mold. A description and specifications for a panel cubicle with controls for the ladling unit are also given.

High Vacuum Pumps: 173
Leiman Bros., Inc., 4-page folder. This technical sheet describes the design and advantages of a new radiator air-cooled lubricating system in two high-vacuum pumps. Tabular data and photos with location of parts are offered. The new pumps produce 24" to 29.9" vacuums with capacities of 15 to 40.8 cfm. Manufacturers of the pumps say the air-cooled systems operate at temperatures 100 F. lower than regular water-cooled systems.

Flow Volume Control: 174
Hays Mfg. Co., Folder No. 231. Flow volume data and product specifications are available in this new folder. A new flow volume control has been developed that delivers a large volume of hot or cold water at one set rate of fluid flow regardless of inlet pressures. The control handles flow rates from 8 gpm. to 22 gpm.

Carbon, Tool Steel Hardening: 175
Lindberg Engineering Co., 4 pages, 2-color bulletin 97-HS. The complete line of the company's hydryzing furnaces for hardening high carbon and high speed

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tool steels are presented. Cross-section and flow diagrams, specifications and performance data on preheat and high speed furnaces are listed in this technical folder. Also included is a discussion on the operation and features of the company's hydryzing generator, a fully automatic process for producing atmosphere.

Melting Furnace Auxiliaries: 176

Lindberg-Fisher Div., Lindberg Engineering Co., 8-page, 2-color bulletin No. 601. A full description of the complete line of auxiliary items used in conjunction with melting furnaces in the foundry has been issued. High temperature cements, replacement linings, silicon-carbide base blocks, oil burners, blowers, cast iron pots, and oil or gas fired bell ladle heaters are listed. Charts covering dimensions, burner and blower ratings, and burner cross-section diagrams are also provided.

FINISHING

Automation In Barrel Finishing: 177

Almco Div., Queen Stove Works, Inc., 10-page brochure. A detailed description of the company's two submerged-type barrel finishing systems is offered. The illustrated pages show the skip station system and the in-line systems together with flow diagrams explaining each.

High Speed Plater: 178

Bart-Messing Corp., 1 page, catalog sheet. Illustrations and information on the company's new "jet" plater have recently been released. The unit is described as a complete electroplating plant in a compact, portable cabinet. Details and specifications of the plater are presented in an easy-to-read manner, with lines directing the reader to the location on the photographs of the components being described.

Sleeves, Socket Precision: 179

Scully-Jones & Co., 4-page bulletin No. 7-50. The bulletin describes and gives the specifications for precision sleeves, extension sockets, "use-em-up" sleeves, and turret tool holders. Prices for the various models of each are listed.

Protection For Copper, Brass: 180

Conversion Chemical Corp., Information has been released on a new chrome sealer especially designed to eliminate "spotting out" on thin copper and brass plate. The new sealer is also recommended for sealing copper, brass, and porous castings without attacking the metal. Simple to use, the preparation is considered excellent for buffed surfaces.

Industrial Diamond Products: 181

Diamond Tool Research Co., Inc., catalog-folder No. 5. Of special assistance to purchasing agents and diamond product users, this book gives price lists, specifications, and general information about diamond dressing and trueing tools, cutting and boring tools, powder, compound, and plated mandrels. Direct descriptions of the qualities of diamond tool stones are offered together with blueprints of the tools.

Heating Process System: 182

Jensen Specialties, Inc., 15-page catalog. This new booklet explains latest techniques in modern process heating, including a method of combining radiation with convection. Included is a detailed coverage of applications of booster ovens and complete systems, with information on panel segments, wiring channels and conveyors. A series of photo-stories show these parts in a number of applications.

Mirror Finish From Silver Plating: 183

Sel-Rex Precious Metals, Inc., 8-page brochure. A new silver plating process is said to give a mirror-bright finish directly from the bath through a complete range from flash to extra heavy deposits. Full information and technical instructions on the new process has been prepared. Other features of the plating production include hard and ductile deposits, less fumes, less tendency toward bath decomposition, and throwing power that affords uniform thickness of plating. The process operates in a range of current densities from 10 to 40 amperes per sq. ft.

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ALUMINUM CASTINGS for future AUTOMOBILE PRODUCTION

Will they lower costs as well as weight?

By F. S. Ross, Vice-President in charge of Engineering Centr-O-Cast and Engineering Co.

For years, European automobile manufacturers have employed aluminum castings to reduce vehicle weight . . . permitting smaller engines and lower fuel consumption. In America, where fuel economy is not a major problem, the future of aluminum automotive castings depends on different advantages of lightness . . . better steering, rideability, unsprung weight . . . and on cost. Some engineers believe that only by reducing unit costs will aluminum castings replace ferrous metals.

But can modern fabricating techniques make a lower-priced part from a higher-priced raw material? In many cases, the answer is yes. A recent article in Modern Castings magazine, entitled "Centrifugal Casting of Unusual Shapes in Non-Ferrous Metals," outlines how the centrifugal process can greatly cut unit cost. The specific example is a torque converter component, and on this part, savings of more than 20% over previous materials and methods are reported. Similar savings have been effected on other aluminum parts such as power steering housings, transmission housings, and automatic transmission extensions.

Die casting, due to its accuracy and speed, has also resulted in cost reduction with aluminum. As in centrifugal castings, closer dimensions are held than with sand-cast ferrous metals, thus reducing or eliminating finishing operations, and the aluminum alloy's faster cutting speed makes further savings in machining possible.

Although many components of our cars are already cast aluminum, research and development work on gear boxes and engine blocks may open up the largest volume application of all. Engine block research is in an advanced stage, and the next few years should see a major conversion to aluminum here.

With our facilities, our experience (from idea to finished product) in permanent mold, centrifugal mold, and die casting, and our location right in Detroit, we at Centr-O-Cast & Engineering are in an ideal position to lend assistance to not only automotive designers but those in other fields as well. Engineers who have new aluminum applications in mind, and would like to know details of fabricating techniques or costs, will find that we can give them useful information, promptly.

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53

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How To Control Temperature In Die Casting Dies

Part 2 -- Causes Of Thermal Unbalance

By W. M. HALLIDAY

In the first portion of his article, Mr. Halliday discussed the mechanics of heat transfer in a die casting die.

The Effect of Other Factors. Although the foregoing description of the basic mechanics of heat transfer to the die holds good for all cases, it must be pointed out that even with the simplest form of die there will always be some—and often many — *additional factors* coming into operation. The effects of such factors will generally be to modify heat transfer, accumulation, diffusion or dissipation to and from the die. In many instances, the influence of such factors may be chiefly concentrated upon some localized zone in the die. As a result of heat variations thus caused in that particular region thermal unbalance may accrue in addition to untoward variations in temperature.

These additional factors will primarily originate from the following sources which to all intents are unavoidable with any type of hot-chamber die casting machine, or any type of die.

With any machine, each charge of molten alloy has to travel an appreciable distance from the pump reservoir in the metal-pot to the die. This means that injection must always occupy a certain length of time, the duration of which will vary according to the type of machine, the injecting pressures employed, the fluidity of the molten alloy, and the efficiency of the pump mechanism.

Likewise the actual filling of the die cavity will never occur instantaneously, but must occupy a measurable amount of time, according to the distance the alloy stream has to flow to all regions of the cavity, the character and capacity of gate openings, runner lay-out and size and similar features. With most dies the time required to fill the cavity will vary far greater than the time of actual injection operation.

Because of this circumstance, the injected charge of alloy surrenders some of its heat while flowing through the sprue-channel, runners, gates and cavity. Thus the amount of heat transmitted by the alloy charge to any unit area of the surfaces of the above die portions during injection, will be a function of the ratio of the time period in which the flowing alloy charge is in direct contact with the particular unit of die area.

For the same reason these portions of the cavity most remote from the gate entry will receive appreciably less heat during injection shot than those areas situated close to the gate over which almost the whole charge flows in entering the cavity.

Furthermore, the foremost advance layers of the incoming alloy charge which have traversed to the remote regions of the cavity, will have already lost some heat due to normal conductance to the adjacent die metal. Therefore, not only will the remote areas of the cavity receive heat over a much shorter period than those near the gate entry, but they will also receive much less heat per unit of time than the gate areas. Thus a considerable thermal unbalance may easily arise as a result of the different rates of heat absorption and dissipation occurring over these cavity and gate areas.

This condition, however, will not accrue to any serious extent if the heat loss from the exterior surfaces of the die-blocks is proportional—on an area basis—to the heat input at the several localized zones in the cavity. This rarely occurs in practice, because most die casting dies have considerable mass, and an overly great concentration of heat, say at the gate entry region, will be quickly absorbed into the die-blocks and be transferred rapidly to cooler portions of the die.

This means, that any fluctuations in temperature will always be revealed in a much *lesser* degree at the *external* surfaces of the die, than over the surfaces of *internal* formations such as the cavity, interjecting cores, inserts and the like situated in the cavity area. Further, the comparative rate of temperature increase — or decrease — between areas of the cavity situated near to or remote from the gate entry, will become less sharply marked as die casting operations progress from the initial stage, where the die is perfectly cold. It will, in fact, reach a minimum when the whole die mass has attained almost a uniform thermal balance within the optimum temperature range.

Another important localized re-

Continued on page 75

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TEMPERATURE CONTROL

continued from page 73

gion of the die likely to suffer variations in heat is the tapered sprue channel in the stationary die-block. At the parting-joint end of the channel the runners emanate for feeding the alloy charge to the cavity. At any instant during the injection cycle there will be a considerable volume of molten alloy in the sprue channel. In many instances the size of the channel may hold an equivalent or greater volume of alloy than the cavity.

The alloy in the sprue channel will be hotter than the more advanced streams which have entered the cavity and become rapidly cooled by direct contact with its walls. The channel will, in fact, be continually in contact with the hottest streams of alloy throughout the entire injection cycle.

An appreciable proportion of the heat of the flowing alloy will be absorbed by the mass of die-metal around the sprue channel. The result: this area of the die is generally much hotter and the rate of heat increase much greater than any other localized zone in the cavity.

Additional rapid heating will be imparted to the sprue area by the direct contact of the spherical seating at the rear end of the channel with the injector-nozzle whose temperature has to be maintained only slightly below the melting-point of the alloy to ensure free flow and absence of all chilling effects.

As a result of these conditions, with almost every type of die, especially those with centre sprues, it is essential to institute effective control over thermal conditions in the critical sprue channel zone. Such control is also necessary to insure regular, smooth working in respect of certain other practical requirements, as follows.

The heat of the sprue region, to a great extent, determines the condition of the (waste) alloy remaining in the sprue channel immediately injection ceases. For most efficient, uninterrupted operation of the die, this portion of the alloy charge should solidify at a slightly slower rate than the remainder of the charge contained in the cavity. It is important, too, that solidification takes place over the entire length of the plug in the sprue channel, to enable the waste plug to be withdrawn during the ejection stage, with the maximum speed, simplicity and safety.

The rapidity of solidification of the waste sprue-slug has to be controlled to insure it will be severed (during ejection) at a point lying slightly beyond the rear end of the sprue channel. The alloy at this point will be in a pasty, partially solidified state, to induce easiest fracture.

Where a die is worked with the sprue channel region *overheated* the waste alloy slug cannot solidify sufficiently to permit it being severed and withdrawn. Unless an exceptionally long interval is allowed between the termination of the injection cycle and the opening of the die for ejection, much or all of the slug waste will remain highly plastic, breaking very irregularly, perhaps into several pieces. All of these fractures would be within the compass of the channel, and far removed from the nozzle-tip at the rear end so that substantial portions remain in the sprue channel at its rear end farthest removed from the parting-joint surface of the die-block. No further shots would then be possible until the waste material was removed with considerable interruption to the normal casting cycle, delays that would contribute to further thermal unbalance in the die.

If the sprue channel area is *grossly overheated* to a temperature only slightly below the melting point of the alloy, none of the slug material would be chilled sufficiently for normal withdrawal. Immediately upon opening the die the almost molten waste alloy in the channel would ooze out over the parting-joint surface and cause frequent delays between injection-shots, while alloy spatters are cleaned to allow proper closure of the die.

In the case where a die is run with the sprue channel area considerably *under-heated* the waste alloy slug solidifies too rapidly. In extreme cases this may occur to such an extent before the injection stroke is even completed, so that flow is either diminished or entirely cut-off. This would cause partial filling of the cavity and production of incomplete castings. In all cases of premature solidification of the sprue slug waste there will be a considerable loss of pressure on the injected stream entering the die. It also often results in a serious loss of velocity on the flowing alloy stream, producing castings whose internal structure lacks proper density, and are thus weak.

In addition, the prematurely solidified and over-chilled waste slug in the channel will require enormous pressure to sever it from the alloy stalk in the nozzle. Application of such great pressure may result in dangerous overstressing of die-blocks, dowels, or other mechanisms built into the die and also causes frequent delays during ejection.

Furthermore, since the sprue channel zone is in intimate contact with the tip of the injection nozzle, its lack of heat will tend to chill the nozzle. Thus the stream of alloy flowing through the latter is frozen to some extent and the feed to the die may be reduced or even cut-off.

One of the most common drawbacks arising from a die having an underheated sprue channel area is the formation of a waste alloy slug hollow throughout its entire length. This occurs because the outer layers of the alloy stream are progressively chilled in rapid manner by contact with the cool walls of the sprue channel. A stage is thus reached near the end of the injection stroke, where only the internal region of the sprue slug is molten and fluid. During this terminal portion of the injection shot, feed will only be possible through a very much restricted size of sprue opening. Imperfectly formed or structurally weak castings may therefore be produced; while difficulties attend the withdrawal of such hollow waste sprue plugs.

PATENTS — Continued

the solvent in sufficient amounts to maintain a slurry of proper viscosity.

After formation of the shell, the mercury is liquified and allowed to run out of the shell and the solvent to evaporate. The shell is then impregnated with an inorganic binder material in from 0.5% to 7% by weight of refractory material This inorganic binder is one which will bind the refractory together at a high temperature, but below the decomposition temperature of the resinous binder. The shell mold is heated after impregnation to achieve binding by the inorganic material, then the temperature is raised and the organic binder vaporized off, thus removing the resinous material and, at the same time rendering the shell mold porous.

Patent No. 2,749,586 — Everard K. Kohl and Zenon Kazenas—assigned to Mercast Corp.—issued June 12, 1956.

ALUMINUM BRONZE

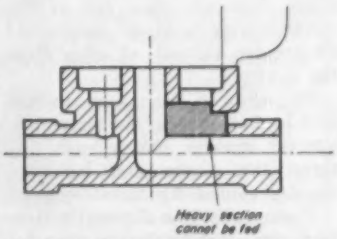
continued from page 54

permanent mold casting of copper alloys. As a result of this the correct design of aluminum bronze castings is not always given the expert attention that is so much a feature of the use of say zinc alloy die castings.

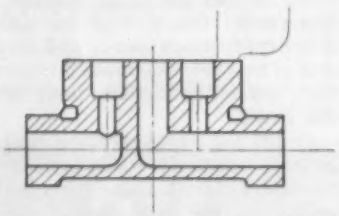
The ruling section of the aluminum bronze component should be as even as possible, basing on a thickness of 1/8″-3/16″.

The molten alloy flows through the gate at a rate of so many cubic inches per second, depending on the 'head' of the runner. If at any part of its travel through the mold the section of the casting calls for a greater flow than that passing through the gate, there will be a halt on the progress of the metal and porosity or flow marks will result. Figure 6 is an example of incorrect design of an aluminum bronze gas valve body, and in Figure 7 is the revised design which has eliminated a critical porosity problem.

Designers who are used to handling die castings in zinc and aluminum alloys expect that most or all holes can be cored in these materials. The same wish comes to those who design permanent mold castings, in aluminum bronze but on account of the high melting point of the alloy the problem is sometimes difficult. Cored holes up to one inch in length and only 1/8″ diameter can certainly be included in the permanent mold castings but they need frequent core replacement.



6. THE ORIGINAL INCORRECT design of this high pressure gas valve body shows how the biggest volume of the casting is situated at its center, with little chance of being properly fed from the gate at the outer rim.



7. THE IMPROVED MOLD DESIGN provides for an increased volume of metal at the throat of the runner with reduction in metal volume near the center. This design provides adequate metal to feed the casting during cooling.

If the casting can be made free from porosity it is often better to drill holes under 3/16″ diameter, and not to include them in the casting. However, if the omission of the small holes causes difficulty in feeding the casting, it may be found necessary to core them and to allow for a heavy cost of core replacement. In such cases the maximum possible taper should be allowed — 2 degrees per side.

In these days when copper alloys are expensive, the cost of core maintenance may be outweighed by a useful saving in raw material cost. Each cored hole should be considered on its merits taking all factors into account.

Cored holes of a more manageable size of 3/16″ diameter and upwards can be allowed only one degree per side taper. If a long cored hole of say 4″ and upwards

For more information circle No. 14 on the Reader Service Card

is required the designer and his caster have to decide whether the hole should be made with one straight through core, which over that length will have a total taper of as much as 0.125 or by two cores, one from each end of the hole, with only half that taper. Unfortunately, this procedure may lead to porosity at the point where the two cores meet and as a general rule it proves better to use the one, straight-through core, in spite of the greater taper.

The aluminum bronze casting should be designed so that it can be readily extracted from the mold immediately it solidifies. A draft of one degree per side is required on faces at right angles to the parting line.

Where local properties which cannot be obtained in the aluminum bronze are required, inserts of other materials can be included, in a similar manner to that used in the die casting process. However, the great strength and corrosion resistance of aluminum bronze means that inserts are not so often required.

Exceptions are to be found for example in the making of components of weighing machines, where hardened steel knife edges are included as inserts. Another example is an aluminum bronze push knob of a colliery electric switch, which has a long slender steel shank as insert. Such a thin portion would be troublesome to run if it were included as part of the permanent mold casting, so it is put in as insert.

Undercut recesses should be avoided wherever possible. By careful attention to design at an early stage in the negotiations many apparently intractable designs can be simplified to avoid undercuts. Sand cores can be used but they present more serious production problems in copper alloy permanent mold castings than in aluminum alloys.

For many years aluminum bronze was a Cinderella among metals. It has always been an alloy that is difficult to handle in the sand foundry but users do not always appreciate that *aluminum bronze is much easier to cast in permanent molds than in sand and furthermore, the mechanical properties are considerably superior.* Steady progress is being made in the special technique of the production of permanent mold castings in this useful alloy and the coming years should see a still greater useage.

ZINC ANALYSIS

continued from page 55

increases the sensitivity and precision of polarographic determinations and eliminates the difficulties of previous methods.

The present method has been used to determine lead and cadmium in zinc-base die casting alloys to be used in NBS Standard Samples for spectographic analysis. Lead and cadmium contents thus determined ranged from 0.0006 to 0.010 percent when copper contents were as much as 1.5 percent. The results obtained polarographically are in excellent agreement with those obtained by cooperating laboratories using more elaborate methods.

[1] For further technical details, see Polarographic determination of lead and cadmium in zinc-base alloys using electrolytic separations at controlled potential, by J. K. Taylor and S. W. Smith, J. Research NBS, 55, 301 (1956) RP 2679.

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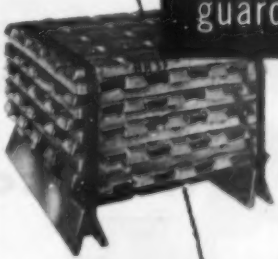

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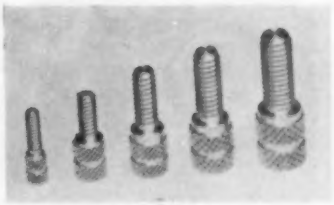
NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 16 of this issue

THREADED INSERT STUDS FOR DIE CASTINGS, PLASTICS



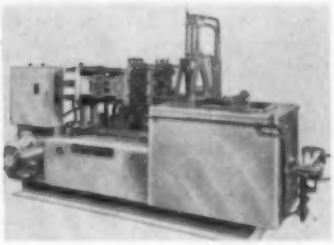
Threaded studs for molding in die castings, plastics, rubber or potting compounds have recently been announced.

These studs are designed to be molded into the product at the time of fabrication; no second operations for inserting or locking are required. The studs are made with a knurled head to prevent rotation in use and are provided with two circular relief bands as added protection against pullout.

All standard thread sizes from No. 2 to ⅜ in. in NC and NF are available. Class 2 threads are standard, but class 3 is available on order. The standard studs are brass, but may be made from steel, aluminum or stainless steel.

Standard Insert Co.
For more information, circle No. 199 on the Reader Service Card

DIE CASTING MACHINE FOR SMALL ZINC CASTINGS



A new die casting machine designed for high speed production of zinc, tin or lead castings weighing up to 3 lbs. has been announced. The machine is said to be well suited for shops specializing in small and medium castings, as well as for shops needing a supplementary machine to handle small dies.

Precision built, the new model includes all the features of the well known larger machines built by this company.

All units have been made easily accessible for extra convenience in adjustment and service. The cycle permits 1300 shots per hour with 1 second dwell. Overall size of the machine is 28″ x 97″ x 48″ high.

Cast-Master, Inc.
For more information, circle No. 200 on the Reader Service Card

ACCURATE SHOT CONTROL LADLES ALUMINUM

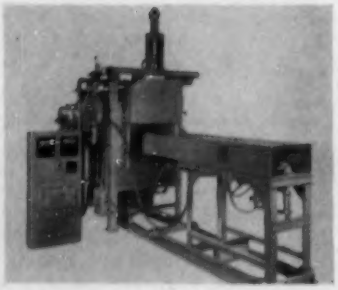
A new automatic ladling unit for aluminum which allows fully automatic processing of many types of castings is now offered. Precise, accurate control of any size shot within its range is provided, with no interruption of the casting cycle during charging of the metal. Although the equipment is normally supplied with a range of 1 to 10 lbs. of aluminum, other size shots in aluminum or other metals are available.

Especially desirable in aluminum die casting and permanent mold, the unit is made of high grade special refractory materials and is arranged so that the molten metal being ladled does not touch any metal structure. Also, there are no moving parts or devices on the basic pump.

The unit operates much like a pressurized chamber, with the size of the shot depending upon both the time of pressure application and the amount of pressure.

Lindberg-Fisher Div.
Lindberg Engineering Co.
For more information, circle No. 202 on the Reader Service Card

REDESIGNED MELTING FURNACE HAS AUTO-LOADING FEATURES



A new, dry-hearth aluminum melting furnace with automatic loading and redesigned burner arrangement has been announced.

According to the manufacturer of the furnace, the auto-loading makes substantial reductions in furnace maintenance by eliminating the random throwing of gates, risers, ingot, etc. into the furnace with consequent damage to the hearth and walls.

A further advantage of the auto-loader is in better working conditions for the operator since he is never exposed to the heat blast from the furnace when the door is opened for charging.

By changing the burner position into the roof of the furnace it is possible to suspend the arch from the frame instead of having it bear on the walls. Thus when rebricking of the walls is necessary it can be done without destroying the arch. This position of the burners is said to give faster more efficient metal melting.

With the auto-loader and redesigned burner arrangement the new furnace has faster production of higher quality metals free from oxide inclusions and gas pickup. Costs are lower due to direct heating and minimum maintenance.

Eclipse Fuel Engineering Co.
For more information, circle No. 196 on the Reader Service Card

BENCH DRILL PERFORMS 3 OPERATIONS AUTOMATICALLY

A new bench-type drilling machine which, by means of two automatic drilling units, one with a 2-spindle head, performs two drilling and one counterboring operation automatically with one loading has recently been announced.

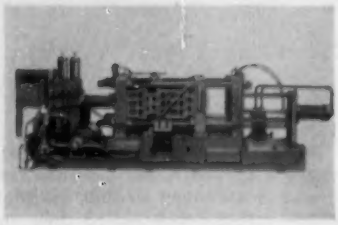
The operator loads and clamps the part in a simple fixture, then depresses the start-cycle switch, whereupon the left-hand drilling unit automatically feeds forward and drills two holes. The withdrawal of the spindles causes the righthand unit to feed in automatically to counterbore one of the two holes previously drilled.

With this simple set-up, the three operations are performed automatically at an output rate in excess of 300 pieces per hour.

By making slight changes in mounting and fixtures, the machine is readily adaptable to drilling a variety of parts.

Govro-Nelson Co.
For more information, circle No. 197 on the Reader Service Card

600-TON DIE CASTING MACHINE HAS ALL-WELDED BASE



A new model die casting machine in the 600 ton locking pressure range has recently been introduced. This machine is reported by the manufacturer to be especially rugged and fast cycling for continuous high speed production of zinc and aluminum die castings.

Some outstanding features of this new machine include: an extra heavy, one piece base of all welded construction; leveling screws in the base so that the machine can be set, and kept, level; a 200 gallon oil reservoir as a part of the base; an integral baffle in the oil reservoir to aid in the removal of sludge and foreign matter; two high capacity magnetic assemblies are suspended in the return lines to remove any particles of ferrous metals from the oil; all-metal filters having a flow capacity of 4 times the pumping capacity are located in the suction lines of the pump.

Other features are two ten-gallon accumulators to give the required shot speed to produce castings with a hardware finish. These are piston type of accumulators to prevent possible nitrogen loss. Tied in with the accumulators is a switch to prevent closing the dies unless the accumulators are at 80 percent of the system pressure.

The moving platen is supported by adjustable bronze wedges which ride on hardened steel base strips. This construction takes all of the platen load off of the tie bars; thus proper alignment at all times is assured.

The machine carries die plates 46½" x 46½", the vertical and horizontal space between tie bars, is 28 inches. Die thicknesses run from 30 inches maximum to 10 inches minimum. Die openings are 8 to 15 inches.

The weight per shot, depending upon the plunger diameter is 3.4 to 10 lbs. of aluminum; 11 to 32.7 lbs. of brass; 2.3 to 6.8 lbs. of magnesium and 2.3 to 25 lbs. of zinc. These shot weights are for plunger diameters from 1¾ to 3 inches on cold chamber machines and from 1¾ to 4⅜ inches on hot

chamber machines.

The machines have two Vickers pumps with a total pumping capacity of over 99 gal. per minute and requires a 30 HP 1200 RPM motor. Heat exchangers, thermostatic controls on water temperatures and many other specials are available as extras.

Cleveland Automatic Machine Co.
For more information, circle No. 198 on the Reader Service Card

"SNUFFER" TYPE FLUID . . . eliminates fire hazards

A new "snuffer" type, fire-resistant hydraulic fluid has recently been introduced. Composed of water, petroleum hydraulic oil and emulsifying agents, the fluid is particularly suited for industries where hydraulic leaks or line breaks could cause fire or an explosion.

The "snuffer" action of the fluid prevents possible combustion by releasing water as a protective steam blanket to quench fire. This reduces local temperatures and displaces oxygen from the immediate area.

Despite the water in its composition, the fluid contains all of the characteristics of petroleum hydraulic oil vital to hydraulically-operated machinery. Also, it is non-corrosive on ferrous and most non-ferrous metals and is compatible with normal system components.

One of the unique features of the fluid is its bright yellow color that permits instant recognition and location of possible leaks.

Shell Oil Co.
For more information, circle No. 201 on the Reader Service Card

HOT LIQUID PUMP . . . for molten metals

A pump for molten salts and metals has been announced. The pump has been found useful for the transfer of molten zinc, lead, tin, magnesium, etc.

Ajax Electric Co.
For more information, circle No. 208 on the Reader Service Card

For more information circle No. 60 on the Reader Service Card

Something OLD..
Something NEW..

AS ONE of the first die casting companies in the Mid West, we combine the knowledge of the past with the progress of the present.

Our recent move into expanded quarters affords us the opportunity of producing zinc die castings more efficiently than ever before.

We would like to explain how these improved facilities can be of benefit to **YOU.**

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For compacting precision metal powder parts for business machines, AMCO Metal Powders are unexcelled.

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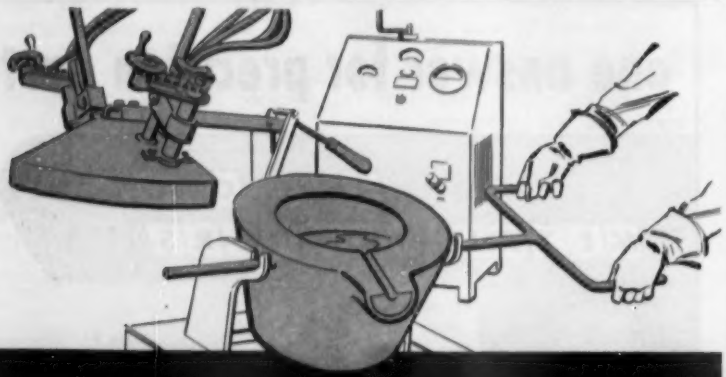

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For more information circle No. 38 on the Reader Service Card

ALLOY STEEL
. . . for die casting dies

A new alloy steel of the chromium, molybdenum, vanadium type that has been developed specifically for such hot working operations as zinc die casting dies and plastic molding dies has been announced.

Called Moldtem, the new steel is available in blocks and bars, prehardened and ready for use without further heat-treatment. A full range of standard cross sections are available and special sizes can be readily produced. The steel is furnished in the hardness range of 302 to 341 Brinell.

The composition and quality control of the new steel give it maximum polishing characteristics and ease of machinability.

While the new material is prehardened, when necessary it can be surface hardened by such processes as intriding, carburizing and hard chromium plating.

Heppenstall Co.
For more information, circle No. 203 on the Reader Service Card

CURVED BARS
. . . for buffing, polishing

Announcement has been made of the availability of curved bar buffing compositions for automatic buffing or polishing operations. The bars are designed to fit curve bar applicators.

A full range of cutting and coloring powers are available in tripoli, stainless, lime or specific coloring compositions. All curved bars have been thoroughly production tested. They come 2″ thick, 4″ wide and on an 8″ radius.

Schaffner Mfg. Co.
For more information, circle No. 214 on the Reader Service Card

TWO-LEVEL GRINDER
. . . uses conveyor-belt

High-speed precision surfacing on both sides of flat parts is possible with a new two-level, conveyor-type belt grinder. The two-side grinder is particularly adaptable to automatic production lines where it can grind both sides of ferrous and non-ferrous metals, plastics, glass, ceramics, and other material in a single automatic cycle.

The conveyor belts have a ½ h.p. conveyor drive and a speed range of 2 to 25 ft. per min. Higher speed ranges are available for special applications.

Engelberg Huller Co.
For more information, circle No. 209 on the Reader Service Card

POWDER METAL PRESS
. . . gives uniform compacts

Recently introduced, a new mechanical compacting press for use with metal powders features one shot, central lubrication, a special volume-controlled filler shoe mechanism, and a new core rod bracket.

The new central lubrication system reaches 21 points in the press, including the clutch, main bearings, and all moving parts. A lever at the front right side of the press makes lubrication easy to perform.

A separated filler shoe insures a measured amount of powder into the die in any desired quantity. Divided into two sections, a hopper and the shoe, the mechanism is cam-operated to deliver a predetermined quantity of powder to the shoe. This is the portion that moves over the die. A damper between the moving section and the powder hopper is cam-operated for the desired amount of powder. Thus a constant volume of powder is delivered assuring more uniform die fill and more uniform compacts.

The new core rod bracket simplifies tool design by permitting the use of short core pins attached to a stationary core rod. Easy access through a door at the front of the press makes installation simple and easy.

Haller, Inc.
For more information, circle No. 216 on the Reader Service Card

SLIP CASTING

continued from page 41

evaluated. This was prepared using the above constituents in the proportions given, except that the slip was heated to 60 C while mixing and then poured. Upon stripping, a relatively hard slip was obtained which was considerably more cohesive than the "cold slip" but consisted of several broken sections rather than one complete section. Repeated trials yielded similar results and it was not possible to cast a good, sound "hot-slip" section in this manner.

The use of commercial corn starch as a replacement for the binder, ammonium alginate, was also investigated. An equivalent weight of corn starch was initially substituted, but a very stiff slip, which would not pour was obtained. The fluidity of the slip was appreciably affected by decreasing the starch content.

Method of Casting. The methods of casting investigated were: drain casting, which, as the name implies, ,consists of filling a mold and allowing the slip to drain into the mold cavity; vibration, in which the mold is filled and vibrated; and centrifugal casting.

Comparison of the three methods was accomplished by filling three molds to excess and subjecting the molds to the conditions of each process. The levels were then qualitatively compared. Centrifugal casting appeared to fill the mold with the greatest amount of slip. This was, therefore, used throughout the casting procedure. The centrifuge with pouring tube is shown in Figure 2.

After casting, the molds were allowed to settle for 48 hours, during which time some of the inherent moisture in the slip disappeared. Stripping was then accomplished by gently hand rolling the as-cast sample out of its mold.

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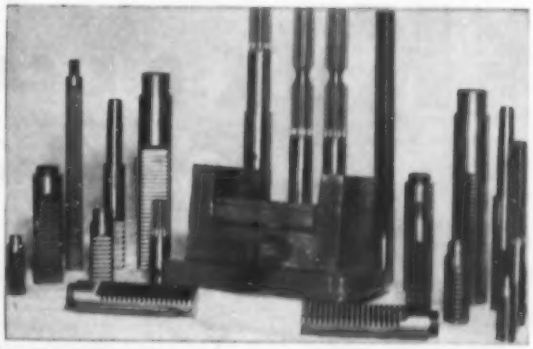

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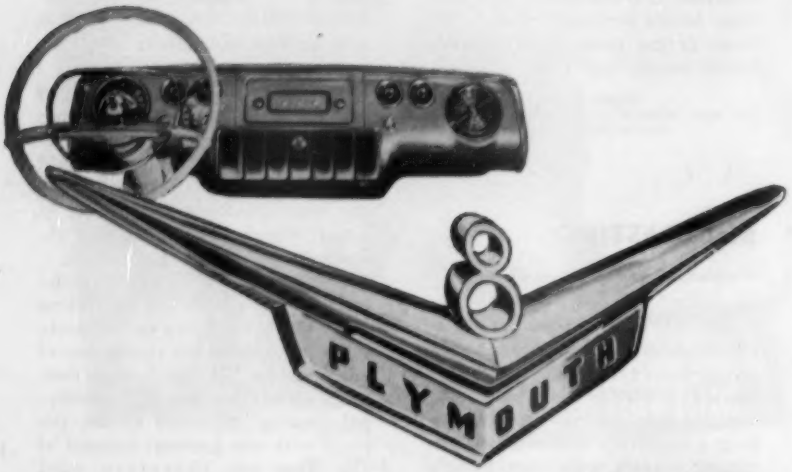

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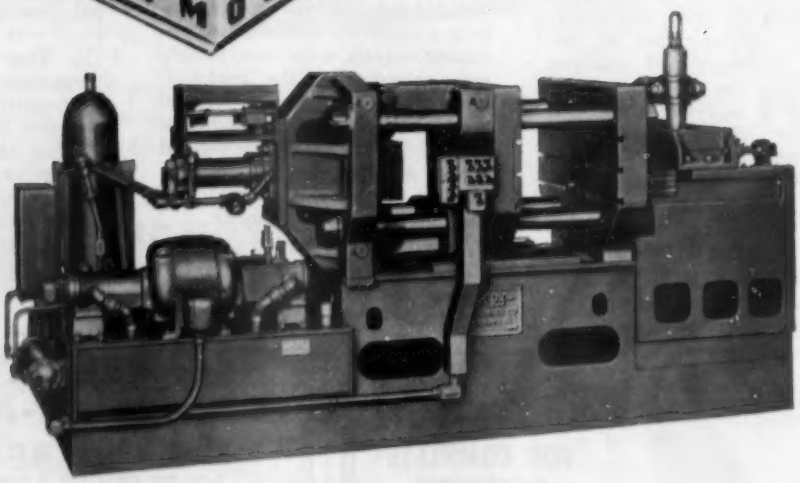

KUX DIE CASTING MACHINES

to get hardware finish quality castings

Big Chrysler Corporation contracts for die-cast trim parts are held by the Trilex Corporation of Wayne, Michigan, and Ajax Manufacturing Corporation of Detroit.

"The primary concern of the Chrysler Corporation is quality," says Mr. John Airey of Trilex. "That's why we chose KUX machines; we know they produce hardware finish quality parts."

"But Chrysler considers price as well as quality," said Mr. Milton K. Pitts of Ajax. "We choose KUX because they put us in a better position to compete on a cost-per-unit basis."

Whether your main concern is lower production costs, quality, or both, investigate the advantages of KUX machines. Quality die castings economically produced often make a tremendous difference in price and salability. KUX, first name in die casting machines, can help make that difference for you! Write for our NEW illustrated catalog.

MODEL BH-30 ILLUSTRATED

Hydraulically operated goose neck plunger type die casting machine for production of zinc, lead or tin castings.

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For more information circle No. 37 on the Reader Service Card

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

SHIPLEY ELECTED BY AFS

Frank W. Shipley, foundry manager at Caterpillar Tractor Co., Peoria, Ill., was recently elected president of the American Foundrymen's Society at its annual business meeting in Atlantic City, N. J.

Shipley is a past national vice president and director of the AFS. He also has served on several national AFS committees and is a past chairman of the society's Central Illinois chapter.

OPEN DETROIT WAREHOUSE

A new warehouse in Detroit has been opened by The Beryllium Corp., Reading, Pa. The new warehouse carries complete stocks of Berylco beryllium copper master alloys, casting ingots, rod, bar and billets.

As a further service, the new warehouse will stock particular alloys, sizes and shapes of parts being used by its customers. Such stocking permits users to reduce their inventories of these alloys and release for other purposes funds normally tied up in alloy stocks.

The new warehouse is located at 17187 Wyoming Avenue, Detroit, Michigan.

ELECT NEW OFFICERS

Bradley B. Evans, sales manager, Empire Steel Castings, Inc., Reading, Pa., was elected president of the Alloy Casting Institute at the close of the Institute's 16th annual meeting June 26. He succeeds Thomas Rutherford, The Midvale Company, Philadelphia, Pa.

Technical association of the high alloy foundry industry, the Alloy Casting Institute comprises most of the nation's leading stainless castings producers.

F. M. Fahrenwald, president, The Fahralloy Company, Harvey, Ill., was elected vice president of the Institute, succeeding Mr. Evans. E. A. Schoefer, Mineola, N. Y., was reelected executive vice president and treasurer.

NEW CANADIAN PLANT CASTS COBALT ALLOYS

A new $1,500,000 investment casting plant has been put into operation by Deloro Stellite manufacturing division of the Deloro Smelting & Refining Co. Ltd. at Belleville, Ont.

Although the new 13-acre plant manufactures more than 500 commercial products, its most important function is investment casting jet turbine blading of Stellite, a cobalt alloy used where a non-corrosive, heat and abrasion resistant metal is required.

The lost wax method is employed primarily by the company in producing the castings but sand and shell mold castings are also used for small quantity runs in Stellite and a full range of other castable alloys.

The Deloro Smelting & Refining Co. helped pioneer the development of cobalt alloys. The new division manufactures 30 different alloys in the Stellite group to meet the needs of most operating mechanical equipment.

More than 300 civic, governmental, and industrial leaders attended the recent plant opening. Top executive officers of the Deloro Stellite division are J. A. O'Brien, president, M. J. O'Brien Ltd.; and B. A. O'Brien, president, Deloro Smelting & Refining Co. Ltd.

NAME SERVICE COORDINATOR

Appointment of Forest G. Boucher as Shalco service coordinator, Shallway Corp., has been announced by William J. White, Shallway general manager.

Mr. Boucher was formerly production superintendent at the Columbia Radiator foundry in McKeesport, Pa. and later at Penn-Scott Foundry in Scottdale, Pa. At Shallway he will be responsible for the handling of Shalco shell molding machines, Shalco shell core blowers, and other Shalco foundry products at the Shalco Demonstration Center in Connellsville, Pa.

R E. CHRISTIE DIES

R. E. Christie, vice president, Crucible Steel Company of America, died suddenly June 27 at New Rochelle, N. Y. Born in 1883, Mr. Christie has been associated with Crucible since 1901, one year after the company was formed. An advocate of the merits of stainless steel since its inception, he lived to see his faith in the future of this specialty steel justified.

TESTS FOR TREATED MAGNESIUM SURFACES

Research toward development of accelerated performance test for treated magnesium alloys is described in an Air Force report released to industry through the Office of Technical Services, U. S. Department of Commerce.

Test methods for evaluating the quality of chemical and electrochemical surface treatments with respect to corrosion resistance afforded by the treatments to the base metal, and the adherence between paint type coatings and the base metal afforded by surface treatments, are needed to determine the acceptability of magnesium alloys submitted to the military services.

Corrosion resistance tests included pH increase in 1.0N KCl, open circuit potential comparisons, short circuit current comparisons, and hydrogen evolution rates in 1.0N KCl (gasometric method). Tests of adhesion of zinc chromate primer to the treated surfaces included adhesion in shear (wrought alloy specimens), adhesion in tension (cast alloy specimens), and impact, ultrasonic vibratory, and pressure-sensitive type tests (qualitative).

The gasometric method was the most promising for evaluation of corrosion resistance.

PB 121140 *Research on Treated Magnesium Surfaces*, S. E. Rohowetz, Bjorksten Research Laboratories, Inc., for Wright Air Development Center, July 1955, may be ordered from OTS, U. S. Department of Commerce, Washington 25. It contains 187 pages, price $4.75.

For more information circle No. 75 on the Reader Service Card

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HIGH SPEED
A.B.C. DIE CASTING
MACHINE

Free Cycles Over 1000 Shots Per Hour

Here's the new A·B·C high speed, low cost die casting machine which eliminates costly production of small die castings on large die casting machines. Air operated, the machine produces small non-porous lead, tin and zinc alloy precision die castings up to 1½ lbs.

The A·B·C is economical to operate and easy to set up. Its lightning production speeds makes single cavity molds practical and profitable.

STANDARD EQUIPMENT INCLUDES:
- 4 TIE BARS
- AUTOMATIC TIMING
- CALIBRATED TEMPERATURE GAS CONTROL
- GAS BURNERS
- DIE BLOCKS
- AIR REGULATOR
- FILTER
- OILER
- SAFETY SHOT INTERLOCK

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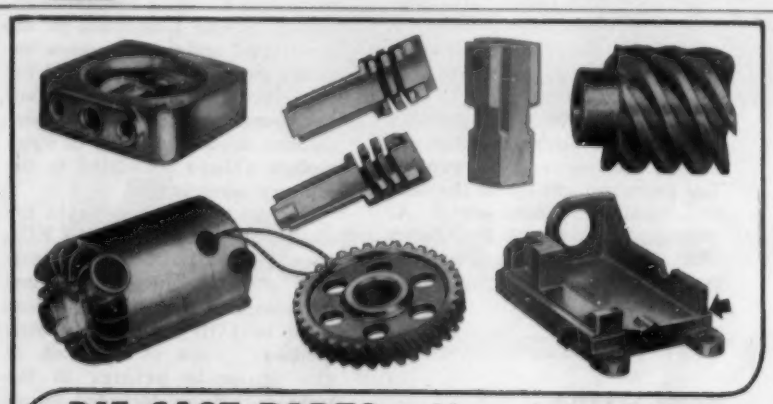
SELL VACUUM MELTING PROCESS AND PATENTS

Allegheny Ludlum Steel Corp. and the Midvale-Heppenstall Co. of Philadelphia, Pa., have completed an agreement for the sale by Allegheny Ludlum of technical knowledge and patent rights for the consumable electrode vacuum remelting of steel and ferrous group base alloys, the two companies have announced.

Under the terms of the agreement, Allegheny Ludlum is furnishing its know-how in consumable electrode vacuum remelting, furnace design, and production. The process will be the same as has been used in a new production department Allegheny Ludlum opened at Watervliet, N. Y.

High temperature superalloys produced by Allegheny Ludlum in consumable electrode furnaces are being used in jet engines.

While the installation of the commercial plant in the A-L Watervliet plant last year multiplied ten-fold the total available vacuum produced material, demand has far out paced the supply. Allegheny Ludlum recently completed an expansion of its own plant and has also announced plans for still further expansion.



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STEEL CASTINGS FOR AIRCRAFT USE

An outstanding survey of steel castings in the aircraft industry today, their potential, the status of government sponsored development, and suggestions for a planned development program directed to full realization of steel castings usage in aircraft.

This report should be in the hands of every investment casting foundryman who is concerned with the future of the castings industry in general and the investment casting industry in particular.

Through the cooperation of Roger Waindle who is serving as Chief of the Castings Branch, Iron and Steel Division of BDSA and Roy Tindula of the Office of Technical Services this report is now available.

You can obtain your copy by writing: OFFICE OF TECHNICAL SERVICES, Department of Commerce, Washington 25, D.C. (refer to PB 121148) (Cost per copy $1.75)

METAL RESEARCH LAB. IN MINNESOTA

The Senate has passed S-3508, a bill to provide for the establishment and operation of a mining and metallurgical research "establishment" in the State of Minnesota.

MISCO TO BE 2ND LARGEST INVESTMENT FOUNDRY

Misco Precision Casting Co. of Whitehall, Mich. has released the artist's conception of their new plant now under construction at Muskegon, Mich. Scheduled for late this year, the completion of this plant will rank Misco as the second largest producer of investment castings in the world.

According to Theodore Operhall, Misco president, the new plant will occupy over 85,000 square feet of office and manufacturing space for the manufacture of investment castings. When under full production, the Muskegan facility will employ 1,200 people. At present, Misco employs 650 at its Whitehall operation and 350 at Detroit.

The company has specialized in the production of blade and vane components for gas turbine application and is currently participating in many of the major jet engine programs. It is also actively engaged in the production of elements for locomotive turbines; turbo-superchargers; automotive gas turbines; and stationary power plants that require investment cast parts of various types.

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NAMED PLANT MANAGER

The appointment of Edward J. Vargo as Plant Manager of the Alloy Precision Castings Company of E. 45th and Hamilton Avenue, Cleveland, Ohio, was announced today by Frank W. Glaser, Executive Vice President and General Manager of the company.

Mr. Vargo is a graduate of Case Institute of Technology where he received his Master's Degree in Physical Metallurgy. On December 15, 1955 he was appointed Chief Metallurgist of Alloy Precision Castings Company, and his newest promotion became effective recently.

HEADS NEW FORD PLANT

Elvin W. Day has been named plant manager of Ford Motor Company's new aluminum castings plant which will be constructed near Sheffield, Ala.

The appointment was announced in Dearborn, Mich., by D. J. Davis, vice president — manufacturing.

The 250,000-square-foot facility will be completed late in 1957. Offices of the new plant will remain in Dearborn until early next year.

A graduate of the Henry Ford Trade School, Mr. Day first joined Ford in 1923.

MAGNESIUM ASSOCIATION ELECTS OFFICERS

Minor changes were made in the slate of officers of The Magnesium Association at its annual meeting in Colorado Springs, May 31 and June 1. D. T. Wellman, president Wellman Bronze & Aluminum Company, Cleveland, was re-elected vice president, and P. B. Craighead, president of Magnesium Products of Milwaukee also was elected a vice president. James V. Cosman, president, Superior Bearing Bronze Company, Wood-ridge, N. J. was re-elected treasurer.

Named as directors for the coming year were: S. E. Bohn, Howard Foundry Company; Wiser Brown, Aluminum Company of America; E. S. Christiansen, Magnesium Company of America; P. B. Craighead, Magnesium Products of Milwaukee; A. Christello, American Light Alloys, Inc.; R. D. Ferguson, Bendix Foundries; Otis E. Grant, Magnode Products, Inc.; J. D. Hanawalt, Dow Chemical Company; J. B. Heisler, A. C. Williams Company; C. E. Larson, White Metal Rolling & Stamping Company; W. H. Osborne, Acme Aluminum Foundry Company; J. E. Pepall, Magnesium Company of Canada Ltd.; E. H. Perkins, Brooks & Perkins, Inc.; R. D. Taylor, Federated Metals Div., American Smelting and Refining Company; and John Thomson, Dominion Magnesium Ltd.

Jerry Singleton continues as Executive Secretary of the Association which headquarters at 122 East 42nd Street, New York.

NAMED VICE PRESIDENT

Gordon Kiddoo, vice president of National Research Corporation has been elected vice president and general manager of NRC Metals Corporation, it has been announced by President Richard S. Morse.

NRC Corporation, a wholly owned subsidiary of Naional Research Corporation has recently signed a $22,750,000 contract with the Atomic Energy Commission to supply annually 700,000 pounds of zirconium metal for a 5 year period. It is building a plant to produce this metal near Pensacola, Florida. Zirconium is unique for its combination of strength, corrosion resistance and low neutron absorption rate, which permits efficient utilization of nuclear fuel.

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OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio.

MAINTENANCE ENGINEER — Large New England die caster requires competent mechanic familiar with hydraulic circuits and equipment. Qualified applicants forward resume with salary expectations to Box No. 8156.

MACHINERY WANTED—Stokes Tabletting Presses - F4-F-E-T4. Mansol Ceramics Co., Belleville, New Jersey, Plymouth 9-8600.

ESTABLISHED MANUFACTURERS' REPRESENTATIVE with offices in Detroit covering states of Michigan, Ohio, Indiana and Kentucky interested in representing precision casting manufacturer. Our personnel is qualified to sell and service. Write Box No. 8256.

LESTER DIE CASTING MACHINE — HP-1-C for aluminum, 225 tons locking pressure. New in 1953, little used. In good running order. May be inspected in production. Reason for selling: need larger machine. Magnesium Industries, Inc., 1313 Kalamazoo St., South Haven, Mich., Phone 1163.

LETTERS

continued from page 28

TECHNICAL DATA

Please send me a copy of Section 1 Technical Data shown in the June 1956 issue of Precision Metal Molding's 1956 Investment Casting Directory. The information contained is of great value and the availability of quick reference would be of much benefit. — W.F.S. (Engineering)

While we are glad to forward tear sheets as long as our supply lasts, we suggest that readers who are interested in extra copies of the complete set of alloy specifications for investment casting write to the Investment Casting Institute, 27 East Monroe St., Chicago 3, Ill. — Ed.

DIE CASTING BY PARAMOUNT

5 REASONS WHY

A DIE CASTING PRODUCED A BETTER PART FOR LESS

1. Eliminated a multi-piece assembly.
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precision made from exclusively formulated non-ferrous Sintroloy and Ductiloy are molded to close tolerances, thereby eliminating machining of intricate shape and high scrap loss.

Perhaps we may be able to help you solve specific parts problems. Get in touch with National Molded today for prompt attention.

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INDEX OF ADVERTISERS: AUGUST, 1956

A

A.B.C. Die Casting Machine Co. 86
ACF Industries 72
Accurate Die Casting Co. 56
Acheson Colloids Co. 45
Advance Tool & Die Casting Co. 54
Allied Research Products, Inc. 61
Alloy Metal Powders, Inc. 54
Aluminum Smelting & Refining Co. ..... Cover II
American Metal Co. Ltd. 81
American Radiator & Standard Sanitary Corp., Ross Heat Exchanger Div. 32
American Zinc Sales Co. 78
Apex Smelting Co. ..... Cover IV
Auto-Diesel Piston Ring Co. 33

B

B & T Machinery Co. 68
Badger Die Casting Corp. 76
Bethlehem Steel Corp. 12

C

Cannon-Muskegon Corp. 34
Carbide & Carbon Chemicals Co., Div. Union Carbide & Carbon Co. 37
Cast-Master, Inc. 1
Centr-O-Cast & Engineering Co. 72
Chemical Corp. 67
Cleveland Automatic Machine Co. 17
Contorming Matrix Corp. 64
Conversion Chemical Corp. 84
Crucible Steel Co. of America 5, 9

D

Dean Precision Castings, Inc. 83
Detroit Electric Furnace Div., Kuhlman Electric Co. 82
Detroit Mold Engineering Co. 62
Dodge Steel Co. 8

E

Esbec Barrel Finishing Corp. 70

F

Fiske Bros. Refining Co. 74

G

Glidden Co., The 31
Frederick Gumm Chemical Co. 64

H

Hanson-Van Winkle-Munning Co. 58
Henning Bros. & Smith, Inc. 77
Hoeganaes Sponge Iron Corp. 74
Hoover Co., The ..... Cover III
E. F. Houghton & Co. 18
Hydraulic Press Mfg. Co. 27

I

Inductotherm Corp. 74
International Minerals & Metals Corp. 90

K

Kuhlman Electric Co., Detroit Electric Furnace Div. 82
Kux Machine Co. 84

L

Lake Erie Engineering Co. 14-15
Lester-Phoenix, Inc. 7
Lindberg Engineering Co. 30
Litemetal Dicast, Inc. 71

M

Madison-Kipp Corp. 4
Magnesium Industries, Inc. 82
Merriman Bros., Inc. 87
Micronized Metals, Inc. 86
Milwaukee Die Casting Co. 86
Milwaukee Metalube Corp. 2
Moraine Products, Div. General Motors Corp. 20
Mt. Vernon Die Casting Co. 36

N

National Molded Products, Inc. 89
New England Die Casting Co. 38
Norton Co. 66

O

Oakite Products, Inc. 70

P

Paramount Die Casting Co. 89
Parker White-Metal Co. 13
Peerless Aluminum Foundry Co., Peerless Die Cast & Permold Div. 87
Peerless Gear & Machinery Co. 83
Peters-Dalton, Inc. 63
Precision Castings Co., Inc. 11
Precision Piston Rings, Inc. 21

R

Reese Metal Products Corp. 33
Republic Steel Co. 29

S

St. Joseph Lead Co. 26
Sel-Rex Precious Metals, Inc. 65
Shell Oil Co. 22-23
G. W. Smith & Sons, Inc. 24
Stroh Die Casting Co., Inc. 81

T

Twin City Die Casting Co. 28

U

U. S. Reduction Co. 19
Universal Die Casting Co. 88

V

Vanadium Alloys Steel Co. 25

W

Westinghouse Electric Corp. 10

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The Remington Typewriter base is a one-piece die casting made by The Hoover Company. It was designed as a die casting because this was the most economical way to produce the desired surface finish and because the complex shape of the item would make any other production method far too costly.
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Solid base for savings

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In 15 years several hundred thousand Remington Typewriters have been built on bases die-cast by The Hoover Company. As with many other leading American manufacturers, Remington Rand has found that die-cast parts mean faster, simpler assembly, improved product appearance and strength with elimination of dead weight.

If you use aluminum or zinc die castings, or if you think you *could* use die castings in your product, ask a Hoover engineer to call.

The Hoover Company
Die Castings Division
North Canton, Ohio

HOOVER

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MEMO TO:

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plus added fluidity

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APEX aluminum alloy 39-11 affords you high, uniform quality that keeps your customers better satisfied. Through smoother-running, more economical production, you enjoy substantial dollar savings, too. Apex 39-11 contains 11 per cent of silicon, assuring an increase in yield strength, pressure tightness and fluidity. You're all set with excellent casting characteristics, mechanical properties and machinability that lets you turn out quality castings as ordered. Specify Apex 39-11 aluminum die casting alloy—and get high fidelity reproduction, with economy. It's another Apex product you can rely on *every time!*

aluminum die casting alloy

...with 11 percent silicon

Send for our helpful booklet, "Die Casting Alloys." Shows composition, properties, other data on Apex products. No obligation.

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